



Development of biology teaching modules based on the RANDAI learning model to improve students creative thinking and collaboration skills

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Article Information	Abstract
Keyword: Teaching module; RANDAI learning model; Respiratory system; Creative thinking skills; Collaboration skills Kata Kunci: Modul ajar; Model pembelajaran RANDAI; Sistem respirasi; Keterampilan berpikir kreatif; Keterampilan berkolaborasi History: Received : 18/02/2025 Revised : 09/09/2025 Accepted : 19/09/2025 Published : 25/09/2025	In the 21st century, students are expected to have 4C skills: critical thinking, creative thinking, collaboration, and communication. Culturally integrated learning has been implemented in learning. Based on the results of observations that have been made, teachers have not implemented a culturally integrated learning model so that learning is not enjoyable and meaningful. This research is a development research. The aim is to determine the level of validity, practicality, and effectiveness of the biology teaching module based on the RANDAI learning model in improving students' creative thinking and collaboration skills. The research subjects were 74 phase F students at SMAN 9 Padang. The biology teaching module development model is the Plomp model which consists of preliminary research phase, development or prototyping phase, and an assessment phase. The research instrument was a closed questionnaire for collaboration and essay questions for creative thinking. The results showed that the validity test had an average of 92.9% with very valid criteria. The results of the practicality test were 86.11% by teachers and 88.62% by students with very practical criteria. The results of the effectiveness test showed the influence of the biology teaching module based on the RANDAI learning model on students' creative thinking and collaboration skills. The conclusion of the RANDAI-based biology teaching module on the respiratory system can provide contextual learning for students and cultural values that can be integrated into learning. These findings confirm that learning integration rooted in cultural context strengthens social and communication skills, fosters empathy and motivation among students, and supports 21st century collaborative competencies. Abstrak. Di abad 21 peserta didik diharapkan memiliki keterampilan 4C yaitu critical thinking, creative thinking, collaboration, dan communication. Pembelajaran yang terintegrasi budaya telah dilaksanakan dalam pembelajaran. Berdasarkan hasil observasi yang telah dilakukan, guru belum menerapkan model pembelajaran yang terintegrasi dengan budaya sehingga pembelajaran belum menyenangkan dan bermakna. Penelitian ini merupakan penelitian pengembangan. Tujuan adalah untuk mengetahui tingkat kevalidan, kepraktisan, dan keefektifan modul ajar biologi berbasis model pembelajaran RANDAI dalam meningkatkan keterampilan berpikir kreatif dan berkolaborasi peserta didik. Subjek penelitian adalah 74 peserta didik fase F di SMAN 9 Padang. Model pengembangan modul ajar biologi adalah model Plomp yang terdiri dari preliminary research phase, development or prototyping phase, dan assesment phase. Instrumen penelitian adalah angket tertutup untuk keterampilan berkolaborasi dan soal dalam bentuk esai untuk keterampilan berpikir kreatif. Hasil penelitian uji validitas memiliki rata-rata 92,9% dengan kriteria sangat valid. Hasil Uji praktikalitas sebesar 86,11% oleh guru dan 88,62% oleh peserta didik dengan kriteria sangat praktis. Hasil uji efektivitas menunjukkan adanya pengaruh modul ajar biologi berbasis model pembelajaran RANDAI terhadap keterampilan berpikir kreatif dan keterampilan berkolaborasi peserta didik. Kesimpulan modul ajar biologi berbasis model pembelajaran RANDAI pada materi sistem respirasi dapat memberikan pembelajaran kontekstual bagi peserta didik dan nilai-nilai budaya yang bisa diintegrasikan ke dalam pembelajaran. Temuan ini menegaskan bahwa integrasi pembelajaran yang berakar dari konteks budaya memperkuat keterampilan sosial, komunikasi, menumbuhkan empati dan motivasi peserta didik yang mendukung kompetensi kolaboratif abad 21.

A. Introduction

Education is a major investment for a nation in producing precious human resources. According to Law No. 20 of 2003, the purpose of education is to develop the potential of students to become human beings who believe and fear God Almighty, have noble character, healthy, knowledgeable, capable, creative, independent and become a democratic and responsible citizen. To realize these educational goals requires capable guidelines, namely the curriculum (Maulinda, 2022). The curriculum will provide active learning, this active learning plan can be poured into the teaching module. The teaching module is a teaching device used by the teacher in an effort to achieve the Pancasila Student Profile and Learning Achievement (CP) (Sufyadi et al., 2021; Salsabilla et al., 2023).

The teaching module is prepared by adjusting the phase or stage of student development (Sufyadi et al., 2021; Setiawan et al., 2022). Teachers prepare teaching modules by paying attention to learning steps that will improve the 21st century skills expected in students. The 6C skills in the 21st century are critical thinking, creative thinking, collaborative, communication, culture, and connectivity skills (Wijaya et al., 2016; Mardhiyah et al., 2021; Montessori et al., 2023). One important step to improve 21st century skills in students is to vary the learning models in the classroom (Kadir et al., 2022; Hidayati et al., 2023). The learning model chosen is a model that makes learning meaningful and enjoyable. According to Provenzo and Eugene (2009) a learning model that is integrated with culture can provide enjoyable and contextual learning for students.

Based on observations at SMAN 3 Padang, SMAN 9 Padang, and MAN 2 Tanah Datar, it is known that teachers have never created teaching modules using learning models that are integrated with culture. From the results of observations, it is also seen that students are less collaborative when studying in groups. From the results of daily assessments using creative thinking skills indicators, it was found that students are still less creative. This is evidenced by the average creative thinking skills of SMAN 9 Padang of 36.33% and 36.97% at MAN 2 Tanah Datar. Therefore, this study was conducted at SMAN 9 Padang. Based on the questionnaire given to students during the observation, it was found that the respiratory system material was difficult for students (46.6%), this was because the scope of the material was too much and there were biological terms that were difficult to understand.

Creative thinking skills are skills that allow students to convey their knowledge from their own perspectives (Feyza & Seyda, 2023). According to Greenstein (2012) there are four indicators of creative thinking skills, namely originality, fluency, elaboration, and flexibility. Collaboration skills are related to learning to plan and work together,

consider different perspectives, participate in activities, listen, and support others (Hidayati et al., 2021). Indicators of collaboration skills according to Greenstein are 1) Working productively with group members in completing tasks or projects; 2) Actively contributing to problem solving; 3) Balance between listening and speaking; 4) Committed to prioritizing group goals; 5) Demonstrating responsibility; 6) Appreciating the contribution of each group member; 7) Managing one's own emotions; 8) Participating respectfully in discussions, debates, and differences of opinion; 9) Recognize and trust the strengths of each group member; 10) Make decisions that include the views of several group members (Aditya & Wahyudi, 2022).

Randai is one of the traditional arts from West Sumatra (Maryelliwati et al., 2018). In terms of pedagogical knowledge, *Randai* art can be synonymous with learning methods, namely the story method and the drama method (*kaba*) (Arsih, 2020a). The syntax of the RANDAI learning model is Reciting (*Bakaba*), Analyzing the Problem (Identifying and Formulating Problems), Narrating the Solution (Planning Problem Solving), Doing the Solution (Conducting Investigations or Collecting Data and Information), Assessing the Solution (Assessing and Reflecting), and Implementing (Implementing in Life) (Arsih, 2020b). Other research related to the development of teaching modules has been conducted by Kurniawan et al. (2023) on the development of CTL-based teaching modules to improve the creative thinking skills of class X students of the Nurul Islam Indonesia Foundation on moss material. Other research related to the development of teaching modules has also been conducted by Nesri & Kristanto (2020); Aransyah (2022); Efendi (2021); and Adawiyah et al. (2022) but has not been integrated with culture.

Analyzing the problem is the stage where students examine and understand the problem presented through *kaba* (story). Narrating the Solution is a *barundiang* activity (group discussion) to plan solutions to solve problems. The Doing the Solution stage is still carried out in groups, where each group carries out activities according to the solution design they have determined. Assessing the Solution at this stage each group presents the results of their investigation in front of the class and facilitates other groups to provide assessments. Implementing, at this stage students can provide solutions to other problems that are similar to those that have been carried out (Arsih, 2020a). Based on the problems that have been raised, this study aims to determine the level of validity, practicality, and effectiveness of the biology teaching module based on the RANDAI learning model in improving students' creative thinking skills and collaboration skills.

B. Material and method

This type of research is development research with the Plomp development model. The stages of research to be carried out consist of the preliminary research phase, the development or prototyping phase and the assessment phase. Formative evaluation is present in all phases and iterative cycles of research design. Formative evaluation has various layers illustrated in Figure 1.

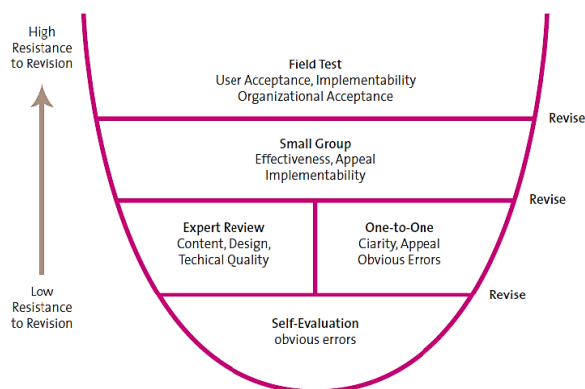


Figure 1 Layers of formative evaluation (Source: Plomp et al., 2013)

Each stage can be explained as follows:

- 1) Preliminary Research Phase. Activities at this stage include conducting curriculum analysis and analysis of problems and needs in biology learning.
- 2) Development or Prototyping Phase. At the development stage, there are several steps, namely a) Prototype I self-evaluation, which is conducting your own evaluation by filling out a checklist, then revising it and moving on to stage two; b) Prototype II validation with experts after revision, proceeding to prototype III; c) Prototype III one-to-one evaluation, which is an assessment by three students; d) small group evaluation is conducted with six students.
- 3) Assessment Phase. An assessment is carried out, a practicality test by the teacher and by a large group of students (field test). This practicality test uses a questionnaire to measure it. Then an effectiveness test is carried out in the form of creative thinking skills questions and collaboration skills questionnaires.

The subjects of the study were students of phase F at SMAN 9 Padang who took the biology moving class. This research was conducted on human respiratory system material. After conducting normality and homogeneity tests from the results of daily assessments, it was found that the Wednesday morning moving class was the experimental group and the Monday afternoon moving class was the control group. This design is called a randomized control-group pretest-posttest design. The research design can be seen in Table 1.

Table 1 Table research design

Group	Pretest	Treatment	Posttest
Experiment	T1	X1	T2
Control	T3	X2	T4

Description:

T1 = Initial test of experimental class

T2 = Final test of experimental class

T3 = Initial test of control class

T4 = Final test of control class

X1 = RANDAI learning model

X2 = Discovery Learning model

The control group was also given treatment, namely by using the discovery learning model. This model is used because in Biology teacher learning at school they are accustomed to using it. The analysis of this research data was carried out using the following steps:

- 1) Analysis of product validity and practicality

It is done by using Formula 1:

$$V = \frac{x}{y} \times 100\% \dots \dots \dots \text{Formula 1}$$

Description:

V = Measured value

x = Score obtained

y = Maximum score

Based on the validity value obtained, the product validity assessment criteria are determined to be valid if the percentage is greater than or equal to 61%. Value categories can be seen in Table 2.

Table 2 Validity value and product practicality

Value%	Category
81-100	Very valid/Very practical
61-80	Valid/Practical
41-60	Quite valid/Quite practical
21-40	Less valid/Less practical
0-20	Not valid/Not practical

(Source: Riduwan, 2006)

- 2) Analysis of the Effectiveness of Teaching Modules
 - a) Analysis of collaboration skills

It is done by using Formula 1. Based on the values obtained, the criteria are determined to be valid if the percentage is greater than or equal to 61%. Value categories can be seen in Table 3.

Table 3 Collaboration skills value

Value %	Category
>80	Very collaborative
60-80	Collaborative
40-60	Somewhat collaborative
20-40	Less collaborative
0-20	Not collaborative

(Source: Nurmayasari et al., 2022)

b) Analysis of creative thinking skills

First, look at the validity, reliability, level of difficulty, and discriminatory power of the questions using ANATES. The value of creative thinking skills can be seen in Table 4. The prerequisite tests were carried out, namely the normality test, homogeneity test, and t-test.

Table 4 The effectiveness value of creative thinking skills

Value %	Category
81-100	Very creative
61-80	Creative
41-60	Quite creative
21-40	Less creative
0-20	Not creative

(Source: Ekawati & Sumaryanta, 2011)

C. Results and discussion

This study was conducted to develop a biology teaching module based on the RANDAI learning model. The development model uses the Plomp model: preliminary research phase, development or prototyping phase, and assessment phase. The

following are the research results sequentially at each stage.

Preliminary research phase

The results of the curriculum analysis show that; (1) the curriculum used is the independent curriculum; (2) learning achievements and elements of learning achievements in the respiratory system material can be seen in Table 5 (3) in the process skills section, students can practice 6C skills where they must observe, formulate questions, analyze data, evaluate, and communicate the results of the investigation.

In the analysis of problems and needs in biology learning, it was found that; (1) teachers have never created a teaching module integrated with culture; (2) from the results of the questionnaire given to students, it was found that the learning materials that were difficult to understand were the respiratory system (46.6%), the excretory system (53.3%), and the regulatory system (43.3%); (3) the color of the LKPD contained in the teaching module that students wanted the most was blue (55%); (4) the analysis of the type of writing desired in the LKPD was Times New Roman (55%).

Table 5 Learning outcomes and elements

Element	Learning outcomes
Understanding biology	At the end of phase F, students have the ability to describe cell structures and bioprocesses that occur such as membrane transport and cell division, analyze the relationship between organ structures in organ systems and their functions and abnormalities or disorders that appear in these organ systems, understand the function of enzymes and recognize metabolic processes that occur in the body, and have the ability to apply the concepts of inheritance, growth and development, evaluate new ideas about evolution and innovation in biological technology.
Process skills	Observing, questioning and predicting, planning and conducting investigations, processing, analyzing data and information, evaluating and reflecting, communicating results.

Development or prototyping phase

The results obtained from the preliminary research stage are used as guidelines in the development of Biology Teaching Modules based on the RANDAI Learning Model on the Human Respiratory System material. The creation of the Teaching Module was carried out using the Canva application. The results of the development carried out at this stage are:

a) Prototype I (Self Evaluation)

Starting from making a storyboard, followed by making a teaching module in the Canva application. After the teaching module is ready, a checklist is made to see the criteria that are already in the teaching module.

b) Prototype II (Validation by Expert)

The results of the validation of the teaching module and collaboration skills questionnaire by experts can be seen in Tables 6 and 7.

Table 6 Teaching module validation results

Aspects assessed	Average (%)	Category
Cover	89.58	Very valid
Content suitability	92.96	Very valid
Content presentation	93.75	Very valid
Language	95.31	Very valid
Average	92.90	Very valid

Based on the Table 6, it can be seen that the biology teaching module have met the very valid criteria. In terms of content feasibility, the Biology Teaching Module that has been prepared has fulfilled the components of a teaching module and can be used in the learning process. In accordance with the statement (Mas'ud et al., 2018; Arofah et al., 2024) that a quality teaching module not only functions as a guide for teachers in learning, but also as a tool that can facilitate the development of 21st century skills for students.

In terms of language, the Biology Teaching Module Based on the RANDAI Learning Model is good, clear and in accordance with PUEBI so that it does not

cause double interpretation (ambiguity) and is easy to understand by students. Supported by what was conveyed by Azizah et al. (2024) and Meiarni et al. (2024), that the use of good or communicative language will make it easier for readers to understand the contents of the reading.

In terms of presentation, the Biology Teaching Module Based on the RANDAI Learning Model has clear learning objectives. Clarity of learning objectives makes it easier for students to learn systematically. This is in accordance with Nurrita (2018) that learning media must be in accordance with learning needs and objectives so that students can obtain good learning outcomes.

Based on the cover aspect, it shows that the design of the biology teaching module based on the RANDAI learning model that was developed is good and attractive, including appropriate images and the writing used is also appropriate. In accordance with what was conveyed by Indriani et al. (2024) the use of traditional media might contribute to the perception that biology is uninteresting. In contrast, technology and interest picture based media has been demonstrated to enhance student motivation by 59% compared to traditional media. The final results of the cover after validation can be seen in Figure 2.



Figure 2
Cover after validation (in Indonesian)

Table 7 Collaboration skills questionnaire validation results

Aspects assessed	Average (%)	Category
Linguistics	92,85	Very valid
Construction	91,67	Very valid
Average	92,26	Very valid

Based on Table 7, it can be seen that the collaboration skills questionnaire has met the very valid criteria. The questionnaire uses language that is easy to understand by students. The choice of words used in the questionnaire is also not ambiguous. In accordance with this Aji et al. (2023) states that Learning tools are said to be easy to use if they use language appropriately with simple, consistent sentences and are easy for students to understand.

The construct aspect of the collaboration skills questionnaire can be seen in the suitability of the statements with the collaboration skills indicators. Other research that also validated the collaboration questionnaire was by Abdelmohsen (2020) and Kusumantoro et al. (2023), that the construct aspect of the collaboration skills questionnaire can be seen in the suitability of the statements with the collaboration skills indicators. Another study that also validated the collaboration questionnaire was by Net et al. (2023), but they only conducted content validity, not construct validity like this study. From this, it can be seen that before being used, the research instrument must be validated first.

c) Prototype III (One to one evaluation)

One to one evaluation was conducted by three students who had different abilities (high, medium, low). The results of one-to-one evaluation can be seen in Table 8.

Table 8 One to one evaluation results

Aspects assessed	Results
Components of teaching materials and LKPD	Contains interesting and complete teaching materials and clear LKPD.
Linguistics	The language used is simple and easy to understand.
Presentation	The presentation of the material is equipped with pictures and LKPD is made according to the sequence of learning syntax

Based on the results of the one-to-one evaluation, it was found that the Biology Teaching Module Based on the RANDAI Learning Model on the respiratory system material that was developed received a positive response from students. Students assessed that the LKPD contained in the Biology Teaching Module Based on the RANDAI Learning Model, already used easy-to-understand language, interesting pictures, in accordance with the indicators

of creative thinking skills, and in accordance with the syntax of the RANDAI learning model. This is in line with what was conveyed by Net et al. (2023); Setiawati et al. (2023); Ardiansah & Zulfiani (2023); and Hikmiyah & Khusaini (2024). The suggestions given by students were that there were still some pictures that were still unclear.

d) Prototype IV (Small group evaluation)

This stage was carried out by six Phase F students who had different abilities (high, medium, low). The practicality test by small group students aimed to see the practicality of the biology teaching module. The results of the small group evaluation can be seen in Table 9.

Table 9 Small group evaluation results

Aspects assessed	Average (%)	Category
Ease of us	91.67	Very practical
Learning time efficiency	91.67	Very practical
Benefits	97.50	Very practical
Average	93.61	Very practical

Based on the ease-of-use aspect with a very practical assessment category, it can be seen that students do not find significant obstacles in using teaching materials and LKPD. The presence of teaching modules containing teaching materials is also equipped with images. According to Utami (2018) images are very attractive to students.

Based on the efficiency of learning time, it is also categorized as very practical. This proves that with the RANDAI learning model, learning time becomes more efficient and students can make good use of their time. Based on the last aspect, namely the benefit aspect, it is categorized as very practical. This shows that the applied teaching module helps students in the learning process. Based on the results of the analysis that have been explained in the biology teaching module based on the RANDAI learning model that has been developed, the teaching module is suitable for use.

Assessment phase

The results at the assessment stage are as follows:

1) Practicality Test

There are two data points from this practicality test, namely student and teacher.

a) Results of practicality test by large group students (field test)

This activity was conducted to see the practicality of the biology teaching module based on the RANDAI learning model by large group students. This assessment was carried out by 30 students. The results of the practicality test can be seen in Table 10.

Table 10 Field test results

Aspects assessed	Average (%)	Category
Ease of us	89.72	Very practical
Learning time efficiency	86.67	Very practical
Benefits	89.50	Very practical
Average	88.62	Very practical

In terms of ease of use for students, there are no significant obstacles in using teaching materials and LKPD, because students have been told to read the instructions in the LKPD. As stated in Setiawati et al. (2023) research, they also equipped the LKPD with instructions for users, this is useful to facilitate the use of LKPD in learning for students.

Based on the aspect of learning time efficiency, it shows that students can use learning time well. In terms of benefits, teaching modules can help the learning process. Because it uses the RANDAI learning model which presents drama and stories in Biology learning, it makes students interested in learning.

b) Practical test results by teachers

This activity was conducted to see the practicality of the biology teaching module based on the RANDAI learning model carried out by one of the Biology teachers of phase F who teaches at SMAN 9 Padang. The practicality test results can be seen in Table 11.

Table 11 Practical results by teachers

Aspects assessed	Average (%)	Category
Ease of us	87.50	Very practical
Learning time efficiency	75.00	Practical
Benefits	95.83	Very practical
Average	86.11	Very practical

In terms of ease of use with a very practical category, it is evidence that teachers also find it easy to use biology teaching modules in learning. The aspect of learning time efficiency gets a value with a practical category. Teachers can make the best use of their time in the learning process using teaching modules based on the RANDAI learning model.

The aspect of benefits gets a score with a very practical category, this shows that the teaching module is very useful in learning. One reason is because the teaching module uses a learning model that is integrated with culture, so that learning is more contextual so that character is formed in students. This is in line with what was conveyed by Sumarni et al. (2024) that a child will go through a process of learning both physically and psychologically (values and norms) which greatly influences the child's learning process, especially from the environment. The cultural environment will help shape children's character in accepting themselves and their world.

2) Effectiveness test

This effectiveness test has two main topics, namely creative thinking skills and collaborative skills of students as follows:

a) Creative thinking skills

The assessment of creative thinking skills was obtained by giving 4 test questions for each meeting. This test has four indicators of creative thinking skills

filled by 74 students consisting of control and experimental classes on the respiratory system material. Both classes were given pretest and posttest questions with the same questions, then the results obtained were processed according to the indicators developed by Greenstein so that the research results for the average creative thinking skills of students were seen in Table 12.

Table 12 Creative thinking skills per indicator

Creative thinking skills indicators	Average			
	Experimental class		Control class	
	Pretest	Posttest	Pretest	Posttest
Originality	35.13	77.29	32.43	64.32
Fluency	35.67	65.40	30.27	55.13
Elaboration	29.72	64.86	24.32	58.37
Flexibility	33.51	65.40	28.64	54.59
Final score	33.51	68.24	28.91	58.10

Originality Indicator is seen in the RANDAI learning model. This indicator is found in the reciting syntax, in line with research conducted by Arsiah et al. (2021). At this stage, students provide ideas for the theme of the problem in the drama that will be performed. In the field, when conducting research, students were not fully able to provide ideas in a different way from the examples in the LKPD. Of the 4 groups, only 1 group was able to provide different ideas for their drama ideas. This is because students are not used to learning biology by doing drama.

If it is associated with the provision of pretest and posttest questions, this indicator will be seen when students give answers. In the students' answers, there are several different ideas. In line with what was conveyed by Mursidik et al. (2015), the less often students give the same answer, the higher the level of authenticity of the answer.

The fluency indicator in the RANDAI learning model is seen when students are at the stage of analyzing the problem (analyzing and identifying problems from the story) and narrating the solution (planning problem solving). At the stage of analyzing the problem, students identify the problems implied by the *kaba* (story) told by the group that is performing the drama. At the narrating the solution stage, students work with their groups to plan a solution to the problem described in the story.

The elaboration indicator in the RANDAI learning model syntax is seen when students are at the narrating the solution and doing the solution stages (conducting investigations or collecting data and information). When narrating the solution, students *barundiang basamo* or sit in groups. When working in groups, students are quite active in discussing together to solve problems found during the reciting or *bakaba* stage. For the doing the solution stage, students solve problems by searching from various available sources. The breadth of

students' ideas will be seen when they describe one by one the right solutions to the problems found.

Flexibility indicators can be seen in learning with the RANDAI learning model when students are at each stage of the RANDAI learning model. Creative thinking skills are very important for students because first, by thinking creatively, students can find various ideas and solutions in solving problems (Aji et al., 2024). Second, with creative thinking skills, students' lives will be more functional and meaningful (Mahfud, 2019). Third, creativity is a reliable source of human resource strength to drive human progress in terms of exploration, development, and new discoveries in the fields of science and technology and all fields of human endeavor (Mardhiyana & Sejati, 2016). Fourth, creative thinking skills can train students to develop many ideas and arguments, ask questions, acknowledge the truth of arguments, and can make students open to differences in arguments (Tendrita et al., 2016). To see the difference in the average in the experimental class and the control class, see Figure 3.

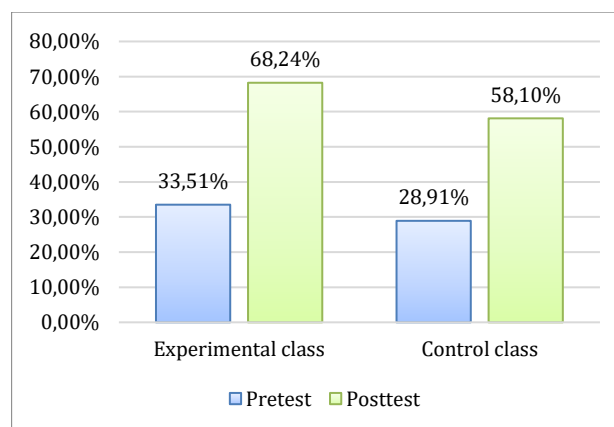


Figure 3 Creative thinking skills diagram

From the picture it can be seen that the creative thinking skills of students in the experimental class are higher than the control class. In the experimental class, creative thinking skills have reached the very creative category. In the control class, there was also a change in students' creative thinking skills, but it did not reach the very creative category. The very creative category did not exist in the control class because during learning, students focused on the teacher's explanation so they could not develop their creative thinking skills. The results of the prerequisites for creative thinking skills can be seen from the results of the normality test, homogeneity test and t-test.

Based on the list in Table 13, it is found that the residual data of students' creative thinking skills are normally distributed. This is because the significant value of the data obtained is > 0.05 , as evidenced by the significant value of the control class of 0.549, the significant value of the experimental class of 0.374. Data variance of creative thinking skills data of students in homogeneous sample classes (see Table 14). This is because the significant value of the data obtained is > 0.05 , namely 0.137. The biology teaching module based on the RANDAI learning model has a positive effect on improving students' creative thinking skills in the respiratory system Phase F material at SMAN 9 Padang (see Table 15).

Table 13 Normality test results

Class	Test of normality		
	Statistic	df	Sig.
Control class	0.975	37	0.549
Experimental class	0.969	37	0.374

Table 14 Homogeneity test results

Test of homogeneity of variance				
	Levene statistic	f1	df2	Sig.
Based on mean	2.264	1	72	0.137
Based on median	1.857	1	72	0.177
Based on median and with adjusted df	1.857	1	68.066	0.177
Based on trimmed mean	2.159	1	72	0.146

Table 15 t-Test results

Independent sample test t-test for equality of means						
t	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
					Lower	Upper
2.862	72	0.006	10.135	3.542	3.075	17.195
2.862	69.022	0.006	10.135	3.542	3.070	17.201

Table 16 Collaborative skills results

Aspects	Experimental class				Control class			
	Pretest		Posttest		Pretest		Posttest	
	Score	Category	Score	Category	Score	Category	Score	Category
A	61.26	K	77.92	K	52.92	CK	64.63	K
B	64.52	K	80.74	SK	52.70	CK	64.52	K
C	65.87	K	84.12	SK	56.75	CK	66.72	K
D	60.81	CK	85.81	SK	56.08	CK	66.55	K
E	61.14	K	84.12	SK	58.10	CK	65.54	K
F	53.37	CK	73.31	K	55.57	CK	59.96	CK
Average	61.16	K	81.00	SK	55.35	CK	64.65	K

Description:

A = Contribution
B = Time management
C = Working with others
D = Investigation techniques

E = Responsible
F = Demonstrates respect
SK = Very collaborative
K = Collaborative

CK = Somewhat collaborative
KK = Less collaborative
TK = Not collaborative

Table 17 Normality test results

Class	Test of normality		
	Statistic	Saphiro-Wilk	Sig.
Control class	0.119	37	0.413
Experimental class	0.123	37	0.244

Table 18 Homogeneity test results

Test of Homogeneity of variance				
	Levene statistic	df1	df2	Sig.
Based on mean	0.075	1	72	0.786
Based on median	0.043	1	72	0.836
Based on median and with adjusted df	0.043	1	70.275	0.836
Based on trimmed mean	0.073	1	72	0.788

Table 19 t-Test results

Independent sample test						
t-test for equality of means						
T	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
					Lower	Upper
-10.147	72	0.000	-7.162	0.706	-8.569	-5.755
-10.147	71.889	0.000	-7.162	0.706	-8.569	-5.755

b) Collaboration skills

Based on the research that has been conducted, data on the collaboration skills of phase F students of SMAN 9 Padang were obtained. Based on the results of statistical calculations, the average (mean), minimum value, and maximum value of the two samples were obtained as in Table 16. Based on Table 16, it is known that the average collaborative skills of students in the experimental class are higher than those in the control class. Research data on students' collaboration skills were obtained from measurement results using a collaboration questionnaire. In collaboration skills, there are six indicators, namely contribution, time management, working with others, investigation techniques, being responsible, and showing respect (Nadhiroh & Trilisiana, 2020). In learning with the RANDAI learning model, the collaboration process begins at the Narrating the Solution stage (planning problem solving).

Learning using the RANDAI model will provide opportunities for students to collaborate. When collaborating, students will learn many things such as practicing critical thinking skills, creative thinking skills, communication skills, and argumentation skills. According to Pamungkas et al. (2023), students with high economy have higher level of 4C skills than those with low economy and to inculcate Indonesian 21st Century Biology Skills to improve students' achievement, and develop well-balanced individuals, teachers should apply the use of computers in the learning and teaching process. This is in contrast to my research which uses a more culturally integrated learning model which uses drama play methods in its learning.

The results of the prerequisites for collaborative skills can be seen from the results of the normality test, homogeneity test and t-test in Table 17 and Table 18. Based on the Table 17, it is found that the residual data of students' collaboration skills are normally distributed. This is because the significant value of the data obtained is > 0.05 , as evidenced by the significant value of the control class of 0.413, the significant value of the experimental class of 0.244. Based on the data in Table 18, the variance of data on students' collaboration skills in the homogeneous sample class was obtained. This is because the significant value of the data obtained is > 0.05 , namely 0.786. The result of t-Test can be seen in Table 19. Based on the data in Table 19, the sig. (2-tailed) result is 0.000 where the value is < 0.05 . This shows that there is a significant difference in collaboration skills between the control class and the experimental class. So, it can be concluded that H_0 is accepted, where the biology teaching module based on the RANDAI learning model has a positive effect on improving students' collaboration skills on the respiratory system material Phase F at SMAN 9 Padang.

The improvement in collaborative skills through the use of the RANDAI learning model can be explained through Vygotsky's which emphasizes that knowledge is formed through social interaction and collaboration in relevant contexts (Palincsar, 2012). The collaborative process in this model is in line with cooperative learning, which states that positive interdependence and individual responsibility are the basis for creating effective collaboration (Scager et al., 2016). Furthermore, the incorporation of cultural elements in learning supports contextual learning theory, in which emotional involvement, values, and

cultural identity increase students' motivation to collaborate (Sukarno & Riyadini, 2024). The collaboration that emerges through narrative and dramatic interactions in RANDAI is not merely group work, but a way to build social, communication, and empathy skills, which are the basis of the 4Cs (Saimon et al., 2023; Kos, 2025). Thus, the results of this study support the idea that effective collaboration stems from cooperative task structures and cultural contexts that are relevant to learners.

D. Conclusion

Based on the research that has been done, we have succeeded in developing a biology teaching module based on the RANDAI learning model on the respiratory system material that is valid, practical, and effective to use. The validation by material experts, learning media experts, and language experts are all included in the very valid category. The results of the evaluation of small groups, large groups, and by teachers are included in the very practical category. The results of collaboration skills and creative thinking skills in the experimental class showed higher results than the control class participants. So that the biology teaching module based on the RANDAI learning model has an influence in improving students' creative thinking skills and collaboration skills. This is confirmed that effective collaboration skills can be developed through learning integration rooted in cultural context. The integration of cultural elements in the RANDAI model strengthens social and communication skills, fosters empathy and motivation among students, which are at the core of 21st-century collaborative competencies.

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