

## Resource based learning design thinking (RBLDT): A model to improve students' creative thinking skills, concept gaining, and digital literacy

**Dominggus Rumahlatu**<sup>a \*</sup>, Study Program of Biology Education, Faculty of Teacher Training and Education, Pattimura University, Jl. Ir. M. Putuhena, Ambon 97233, Indonesia. <https://orcid.org/0000-0002-4466-5528>

**Kristin Sangur**<sup>b</sup>, Study Program of Biology Education, Faculty of Teacher Training and Education, Pattimura University, Jl. Ir. M. Putuhena, Ambon 97233, Indonesia. <https://orcid.org/0000-0003-4576-6328>

**Martha M. Berhиту**<sup>c</sup>, Senior High School 1 Ambon, Indonesia. <https://orcid.org/0000-0002-0332-9667>

**Since Y. Kainama**<sup>d</sup>, Senior High School 2 Ambon, Indonesia. <https://orcid.org/0000-0003-3472-9206>

**Vera V. Kakisina**<sup>e</sup>, Senior High School 12 Ambon, Indonesia. <https://orcid.org/0000-0001-9298-2635>

**Corneli Latupeirissa**<sup>f</sup>, Senior High School Siwalima Ambon, Indonesia. <https://orcid.org/0000-0003-3696-4568>

### Suggested Citation:

Rumahlatu, D., Sangur, K., Berhиту, M.M., Kainama, S.Y., Kakisina, V.V., & Latupeirissa, C. (2021). Resource based learning design thinking (RBLDT): A learning model to improve students' creative thinking skills, concept gaining, and digital literacy. *Cypriot Journal of Educational Science*. 16(1), 288-302 <https://doi.org/10.18844/cjes.v16i1.5528>.

Received from October 12, 2020; revised from December 15, 2020; accepted from February 10, 2021.

Selection and peer review under responsibility of Prof. Dr. Huseyin Uzunboylu, Higher Education Planning, Supervision, Accreditation and Coordination Board, Cyprus.

©2021 Birlesik Dünya Yenilik Arastirma ve Yayıncılık Merkezi. All rights reserved.

### Abstract

This study aims to investigate the effect of Resource Based Learning Design Thinking (RBLDT) model to improve student's creative thinking skills, concept gaining, and digital literacy. It is a quasi-experimental study using pre-test and post-test nonequivalent control group design. Furthermore, it was conducted at several senior high schools in Ambon, such as Senior High School 1, 2, 12, and Senior High School Siwalima Ambon in the odd semester of the 2019/2020 academic year. From each school, three classes were selected, and 36 students were used as the study samples to obtain a total of 432 students. The data were analyzed using ANCOVA, and post hoc LSD test was performed for every significant result obtained. The results showed that the RBLDT learning model has an effect on creative thinking skills, concept gaining, and digital literacy of students in the class XI senior high school on the subject matter of animal tissue ( $p < 0.05$ ). The combination of the RBLDT learning model syntax can improve students' creative thinking skills, concept gaining, and digital literacy better than RBL or DT when implemented separately.

Keywords: Resource-based learning (RBL), design thinking (DT), RBLDT learning model, creative thinking, concept gaining, digital literacy

\* ADDRESS FOR CORRESPONDENCE: Dominggus Rumahlatu, Study Program of Biology Education, Faculty of Teacher Training and Education, Pattimura University, Jl. Ir. M. Putuhena, Ambon 97233, Indonesia  
E-mail address: [dominggus\\_amq@yahoo.co.id](mailto:dominggus_amq@yahoo.co.id) / Tel.: +62-812-4006-9626

## 1. Introduction

Education is currently evolving with the development of the era of globalization and technology (Gamar, Al Faruq, & Lina, 2018; Benjamin, White, MacKeracher, & Stella, 2013). Up to date, the trend of the industrial revolution (IR) 4.0 has also influenced the education system in Indonesia (Lase, 2019; Afrianto, 2018). This has been happening since the industrial revolution and education 4.0 i to achieve the ultimate goal in the era of globalization, such as improving human civilization. According to Hussin (2018), IR 4.0 needs to be fully understood before understanding education 4.0. This is because IR 4.0 affects not only management and social affairs, but also education. Shahroom & Hussin (2018) confirmed that the current view of education has shifted to the trend of IR 4.0, marked with the development of new models in the future education. Furthermore, the education in the trend of IR 4.0 is not only limited to the walls of the schools but also reaches out to the wider world. The wide reach is not in the physical sense but in the non-physical through the internet connection. Nowadays, science is developing rapidly on the Internet, helping students to access knowledge through various sources. This is because learning resources using internet are not limited to time and space. According to Wallner & Wagner (2016) and Suartama, Setyosari, Sulthoni, & Ulfa (2019), the current condition of students' learning method is by using laptops/notebooks, mobile phone, and the information from e-books, articles, and the google search engine. Currently, the information provided by teachers even can often be outranked by google search engine.

One learning model which is equal to the use of various sources to access scientific information is the Resource-Based Learning model (RBL). The RBL is one of the most important learning models used during this time, and it requires students to learn from a variety of sources to access and communicate using technology. Furthermore, it is based on constructivist philosophy while introducing real problems to students by systematically empowering their thinking processes. Therefore, it is one of the important learning models used in this era (Suntusia, Dafik, & Hobri, 2019; Butler, 2012; Yaniawati, Kariadinata, Sari, Pramiasih, & Mariani, 2020). According to Hill & Hannafin (2001), the implementation of this model should contextualize the information sources to make it easier for students to access broad information from various sources. It has been successfully implemented in biology learning (Cui, Zhang, & Chen, 2019), however, to design an innovative learning and different conditions, educators modify learning models using different techniques. The modification can be conducted by reconstructing the stages of RBL learning using the design thinking method.

Design Thinking (DT) is a problem-solving method that focuses on creative solutions to various topics / problems, and emphasizes on team communication and collaboration. Studies have shown that this method can improve the quality of teaching, participation, and students' independence in developing interest and learning to find concepts for independence (Tu, Liu, & Wu, 2018). Therefore, the implementation can contextualize learning materials since several studios showed that the DT method can improve problem-solving, team-work, creativity, and creative thinking skills of students (Jeon, 2019; Carroll, 2014; Scheer, Noweski, & Meinel, 2011). The study by Anderson (2013) reported that the implementation can be enhanced by creative and innovative skills of students. According to Noel & Liub (2017), the design thinking can improve their thinking principles, such as empathy, collaboration and facilitation, relationships with others, and creativity. In addition, according to Darminto (2013), it can be improved by using learning methods or models to accommodate new ideas of student and use them to engage the thinking process. According to Zubaidah (2018) and Palupi, Subiyantoro, Triyanto, & Rukayah (2020), creative thinking is one of the personal skills which can be obtained through training in learning process. Also, it is needed to solve problems in learning (Batlolona, Diantoro, Wartono, & Latifah, 2019).

In addition to developing the creative thinking of students, it is also necessary to develop their concept gaining and digital literacy. Trianggono's study (2017) has shown that creative thinking is constructive and mutually reinforces with the concept of the student. Therefore, creative thinking and concept gaining are the main components in learning. On the contrary, Stork (2020) explained that digital literacy is the one of the life skills of 21<sup>st</sup>-century that involve the ability to use technological devices, information, communication, and its application to improve social skills, learning abilities, critical thinking, creative thinking, and inspiration as digital competencies. Therefore, digital literacy also empowers creative thinking of students.

To develop students' creative thinking skills, concept gaining, and digital literacy, a learning model and method which are considered equal have been combined together. This combination aims to produce an innovative learning syntax, which combined the RBL model and the DT method into a Resource-Based Learning Design Thinking (RBLDT) model. Other studies have also reported their results by combining various learning models. The implementation of complex instruction and team product (CITP) improved student's scientific attitudes, critical thinking skills, cognitive learning results, metacognitive skills, and retention on the material of the ecosystem (Rumahlatu, Sangur, Liline, 2020). The study conducted by Setiawati & Corebima (2018) which combined the Preview-Question-Read-Reflect-Recite and Think Pair and Share (PQ4R-TPS) learning models reported that combination of learning model can increase the metacognitive skills of students compared to the others. Bustami, Corebima, Suarsini, & Ibrohim (2017) reported that the combination of Jigsaw and RQA (JiRQA) learning models can improve social attitudes of students. Furthermore, the combination of RQA and TPS learning models (RQATPS) helps to increase the metacognitive abilities of students by 17.72% higher than is the conventional learning strategy (Syarifah, Indriwati, & Corebima, 2016). Other learning models is reported by Pangestuti, Mistianah, Corebima, & Zubaidah (2015), where Reading-Concept Map learning model is integrated with the Teams Games Tournament (Remap-TGT) to increase reading interest of students.

The observations at several senior high schools in Ambon, Indonesia showed that students' knowledge of animal tissue material, covering the structure and function was still very limited. Therefore, it is necessary to combine Resource-Based Learning and Design Thinking models (RBL-DT). The implementation of the RBLDT learning model was expected to trained students for problem-solving and to provide creative ideas as well as solve problems related to the structure and function of animal tissues. In addition, students were trained to find learning resources to support their comprehension, concept gaining, creative thinking skills, and digital literacy. Therefore, it is necessary to investigate the effect of RBLDT model on creative thinking skills, concept gaining, and digital literacy. The problem statements were:

- Is there an effect of the RBLDT learning model on students' creative thinking skills?
- Is there an effect of the RBLDT learning model on students' concept gaining?
- Is there an effect of the RBLDT learning model on students' digital literacy?

## 2. Method

### 2.1. Research design

This is a quasi-experimental study with pre-test and post-test nonequivalent group design (Dimitrov & Rumrill, 2003). The independent variable is the learning model (RBL learning model, DT method, and RBLDT learning model), while the dependent are creative thinking skills, concept gaining, and digital literacy of students (Table 1).

Table 1. Research design of pre-test and post-test nonequivalent

Treatment group	Pre-test	Post-test
DT method (X1)	Y1	Y2
RBL model (X2)	Y1	Y2
RBLDT model (X3)	Y1	Y2

## 2.2. Research sample

The population was all class XI students of Senior High Schools in Ambon, Indonesia. The samples were determined by using purposive sampling technique (Palinkas, Horwitz, Green, Duan, & Hoagwood, 2015). Furthermore, four schools were selected as samples in the odd semester of the 2019/2020 academic year. The schools were selected based on skills at operating computers, with the same number of students and heterogeneous. The four selected schools were Senior High School 1 Ambon, Senior High School 2 Ambon, Senior High School 12 Ambon, and Senior High School Siwalima Ambon. Then 3 classes were selected from each school, and 36 students were used as the samples, and a total of 432 was obtained.

## 2.3. Instruments

The instruments used were in the form of essay tests and a scoring rubric. The test items were made from standard competency in accordance with the National Education Standardization Agency (NESA), Indonesia. They were in the form of essay tests to measure creative thinking skills and concept gaining of students. In addition, the scoring rubric was a list of criteria to analyzing students' concept gaining, creative thinking skills, and digital literacy. Before the test instruments and digital literacy assessment are used, they need to be analyzed for validity and reliability. The validity analysis used the product-moment correlation test and reliability used the Cronbach-alpha test (Tables 2 and 3). Validity and reliability analysis used SPSS 18.0.

Table 2. The results of validity and reliability of essay test

Item number	$r_{xy}$	Significance value	Interpretation	Cronbach's alpha value	Interpretation
1	.073		Valid		
2	.585		Valid		
3	.694		Valid		
4	.077		Valid		
5	.073	p>0.05	Valid	.856	Reliabel
6	.095		Valid		
7	.471		Valid		
8	.060		Valid		
9	.572		Valid		
10	.050		Valid		

Table 3. The results of validity and reliability of scoring rubric

Item number	$r_{xy}$	Significance value	Interpretation	Cronbach's alpha value	Interpretation
1	.400	p>0.05	Valid	.653	Reliabel
2	.200		Valid		

3	.100	Valid
4	.225	Valid
5	.100	Valid
6	.357	Valid
7	.050	Valid

#### 2.4. Research process

The learning process in each class was carried out almost simultaneously and used different learning materials. However, the assessment of the dependent variables (concept gaining, creative thinking skills, and digital literacy) was the same. The data collection method and the grouping are as follows; the pre-test was administered to all classes before the learning model was implemented. The results of the pre-test of creative thinking skills, concept gaining, and digital literacy were used as covariates in statistical analysis. The implemented learning models were Resource-Based Learning (RBL), Design Thinking (DT), and Resource-Based Learning Design Thinking (RBLDT) models (Table 4). During the process, the students' digital literacy was assessed. The post-test was administered after the learning process, and the results of the post-test were used to measure students concept gaining and creative thinking skills.

Table 4. The combination between resource-based learning (RBL) model and design thinking method (DT)

RBL model	DT method	The combination of RBL+DT: RBLDT learning model
1. Identifying questions or problems	1. Empathy	1. Identifying questions or problems
2. Planning ways to find information	2. Establishing	2. Planning ways to find information
3. Collecting information	3. Brainstorming	3. Collecting information
4. Using information	4. Making Prototypes	4. Using information
5. Synthesizing information	5. Test	5. Brainstorming creative ideas
6. Evaluating		6. Synthesizing information: realizing the creative ideas (prototypes) in the form of new schemes and products
		7. Evaluation

#### 2.5. Data analysis

The data were further analyzed using inferential statistics, beginning with homogeneity and normality analyses. The homogeneity was analyzed using Levene test, and the normality of the data was analyzed using Kolmogorov-Smirnov. Furthermore, Multiple ANCOVA was used to analyze: the effect of RBLDT learning model on students' creative thinking skills, concept gaining, and digital literacy. Furthermore, when the results of the ANCOVA test were significant, a post hoc (LSD) test was performed to determine the average which was statistically significant, and the data analysis was performed using the SPSS 18.0.

### 3. Findings

Before the data were analyzed using the ANCOVA test (Table 7, Table 9, and Table 11), the normality and homogeneity were analyzed using Kolmogorov-Smirnov and Levene test. The results showed that the data were normally distributed (Table 5) from homogeneous population (Table 6).

Table 5. Summary of the results of normality test

Variable	Kolmogorov statistic	Significance	Description
Creative thinking	.979	.643	Normal
Concept gaining	.081	.200	
Digital literacy	.741	.175	

Table 6. Summary of the results of homogeneity test

Variable	Levene statistic	Significance	Description
Creative thinking	.926	.397	Homogeneous
Concept gaining	.211	.256	
Digital literacy	2.555	.122	

The results of ANCOVA on the effect of RBLDT learning model on creative thinking skills of student are presented in Table 7, while concept gaining results are presented in Table 9. Furthermore, the results of ANOVA test on the effect of RBLDT learning model on digital literacy of student are presented in Table 11.

Table 7. The results of ANCOVA on students' creative thinking skills

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	628.502 <sup>a</sup>	3	209.501	87.374	.000
Intercept	16606.357	1	16606.357	6.926E3	.000
Creative prior	.248	1		.103	.748
Learning model	628.393	2		131.038	.000
Error	1026.239	428	2.398		
Total	176702.000	432			
Corrected total	1654.741	431			

Table 8. Test results of LSD test on students' creative thinking skills

Class	Mean	Notation
Resource based learning (RBL)	19.035	a
Design thinking (DT)	19.543	b
RBLDT model	21.811	c

The results of ANCOVA test (Table 7) showed that Fcount of the independent variable RBLDT learning model is F count = 131.038 with a significance value 0.000 ( $0.000 < 0.05$ ). Therefore, RBLDT learning model has an effect on creative thinking skills of students. In addition, the results of the LSD test (Table 8) showed that there is a difference in the implementation of RBL learning, DT method, and RBLDT model on creative thinking skills of students. This can be seen from the different notations of the three models, where the value of the RBLDT learning model is higher than those of the DT and RBL method. Therefore, the students taught by using the RBLDT model have better creative thinking skills than those taught by using the RBL learning model and the DT method.

Table 9. The results of ANCOVA test on students' concept gaining

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	31235.601 <sup>a</sup>	3	10411.867	385.367	.000
Intercept	172130.472	1	172130.472	6.371E3	.000
Concept gaining prior	337.694	1	337.694	12.499	.000
Learning model	31017.901	2	15508.950	574.022	.000
Error	11563.723	428	27.018		
Total	1401362.000	432			
Corrected total	42799.324	431			

Table 10. The results of LSD test on students' concept gaining

Class	Mean	Notation
Resource based learning (RBL)	47.535	a
Design thinking (DT)	53.064	b
RBLDT model	67.636	c

The results of ANCOVA test (Table 9) showed that the independent variable RBLDT learning model has an F count of 574.022 with a significance value of 0.000 ( $0.000 < 0.05$ ). Therefore, the RBLDT learning model has an effect on concept gaining of students. In addition, the results of the post hoc LSD test (Table 10) showed that there is a difference in the implementation of RBL learning model, DT method, and RBLDT model on students' concept gaining. This can be seen from the different notations of the three learning models, where the value of RBLDT learning model is higher than those of the DT method and RBL learning model. Therefore, the students taught by using the RBLDT model have better concept gaining than those taught using the RBL learning model and the DT method.

Table 11. The results of ANCOVA on students' digital literacy

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	345.670a	3	115.223	41.361	.000
Intercept	2769.903	1	2769.903	994.295	.000
Literacy prior	.415	1	.415	.149	.700
Learning model	255.284	2	127.642	45.819	.000
Error	1192.321	428	2.786		
Total	161698.000	432			
Corrected total	1537.991	431			

Table 12. The results of the LSD test on students' digital literacy skills

Class	Mean	Notation
Resource based learning (RBL)	18.0625	a
Design thinking (DT)	19.4861	b
RBLDT model	20.2153	c

The results of ANCOVA test (Table 11) showed that the independent variable RBLDT learning model has an F count of 45.819 with a significance value of 0.000 ( $0.000 < 0.05$ ). Therefore, the RBLDT learning model has an effect on digital literacy of students. In addition, the results of post hoc LSD test (Table 12) indicate that there is a difference in the implementation of RBL learning model, DT method, and RBLDT on digital literacy of students. This can be seen from the different notations of the three learning models, where the value of the RBLDT learning model is higher than those of the DT method and RBL learning model. Therefore, the students taught by using the RBLDT model have better digital literacy skills than those taught by using the RBL learning model and the DT method.

## 4. Discussion

### 4.1. Effect of the RBLDT learning model on students' creative thinking skills

The results of the ANCOVA test (Table 7) showed that the RBLDT learning model has an impact on the creative thinking skills of students. In addition, the results of the LSD test show that the creative thinking skills of students taught by using the RBLDT learning model have a significant difference. The mean score was higher than that transmitted to students using the RBL learning model and DT learning model (Table 8). Therefore, the RBLDT learning model can empower creative thinking better than the RBL and the DT learning models. According to Nuswowati & Taufiq (2015), implementing the appropriate learning models can empower creative thinking skills. Meanwhile, Cheng (2010) explained that creative thinking is considered as an effective way to increase imagination and science concept gaining. Rahardjanto, Husamah, & Fauzi (2019) mentioned that the benefits are that students can modify and reuse information, or even create new ideas or products.

The stages in the RBLDT learning model are combination of the stages in the RBL and DT, which are more effective in improving students' creative thinking skills. During the stage of "planning ways to find information", the students are trained to flexibly search information as learning resources. Awang and Ramly (2008) stated that through creative thinking, students can use different methods of finding information, trying different perceptions, concepts and methods.

The data collection stage began when the students gathered information from various technology-based sources. According to Park (2011) and Kaeophanuek, Na-Songkhla, & Nilsook (2019), scientific creativity can be increased through the thinking dimensions, information searching, interests, beliefs, attitudes, and inquiry. The stage of "brainstorming creative ideas", students are trained to find and obtain various creative ideas. This is similar with the study by Zubaidah, Fuad, Mahanal, & Suarsini (2017) which confirmed that development of five aspects of creative thinking skills can be conducted by using fun learning activities to express ideas in various ways. Miranti & Wilujeng (2017) and Zampetakis, Tsironis, & Moustakis (2007) reported that the use of mind mapping can trained students to freely give creative ideas as well as to develop a concept. Seechaliao (2017) confirmed that the learning process that emphasizes problems and finding solutions through brainstorming ideas can increase creativity.

In the "Information Synthesis" phase, students are trained to develop their creative ideas into innovative products. Furthermore, Birgili (2015) explained that synthesizing activities are parts of creative thinking because of analytical thinking, inferring the final results, presenting new and authentic suggestions as solutions to solve the problems. This stage requires divergent and convergent thinking processes in an integrated manner. McAuliffe (2016) and Lubart (2016) added that divergent thinking alone cannot produce creativity. Meanwhile, convergent thinking is also needed to choose the right information to overcome diverse thoughts. Creative thinking is related to trained cognitive processes rather than to innate talents such as increased working memory, mental management and object manipulation (Scott, Leritz, & Mumford, 2004; Ritter & Mostert, 2016). Sitorus & Masrayati

(2016) explained that the stages of creative thinking process consist of preparation, incubation, reviewing, and verification, or evaluation.

With the implementation of the RBLDT learning model, the students have the opportunity to practice and increase their creative thinking skills during the learning process. This has an effect on their ability to answer test questions in the final test (post-test), and they are required to provide original, flexible, and fluent answers. Istiyono, Dwandaru, & Rahayu (2018) also explained that students with good creative thinking skills will produce various answers to the problems. In addition, Ummah, In'am, & Azmi (2019) confirmed that the indicators of their creativity are the originality and flexibility in the answers or products of the students. Sternberg (2006) also explained that their ability to produce useful and quality work shows the level of creativity. This is shown through two-dimensional and three-dimensional products about various animal tissues. Kacan & Şahin, (2018) also stated that creativity is an important part of human development in the digital era today.

#### 4.2. *The effect of the RBLDT learning model on students' concept gaining*

The results of the ANCOVA test (Table 9) showed that RBLDT learning model has an effect on concept gaining of students. Furthermore, the results of the post hoc LSD test are shown that the significant different on concept gaining was taught by using RBLDT learning model. The average score is higher than those of the students taught by using RBL and DT learning models (Table 10). According to Carpenter & DeLosh (2006), a learning strategy which has a contribution towards cognitive thinking of students can improve the retention of the concepts learned.

The RBL learning model emphasizes on the students activities to find learning sources without any limitations. This may be from the internet or text books since teachers are not the only learning source for students (Butler, 2012). Design Thinking (DT) is a learning method which collaborates systematic processes focused on human as the users to produce a change in behavior, innovation and mind control (Hassi & Laakso, 2011; Tu et al. 2018). While the RBL method emphasizes on the search of information without limitations, the DT method emphasizes on the process of planning to use human mind systematically. Therefore, the implementation of RBLDT learning model is the combination of the syntax which focuses on the search of information from various sources to produce the systematic answers from students. This will develop the thinking patterns of students and helps them to comprehend the concepts. In addition, the systematic answers will help them to understand the learning material well. The study conducted by Rumahlatu et al. (2020) showed that the process of collecting information, investigating, and making scientific products can improve cognitive learning results which contributes to their concept gaining.

Based on the explanation above, it is known that the syntax of the RBLDT learning model can provide a conducive learning environment. Therefore, it has a positive effect on concept gaining of students. This is similar with Karpicke (2012), where the process of accessing knowledge from memory can be carried out with the assistance of learning environment. Shaw, MacIsaac, & Singleton-Jackson (2019) added that the process is through recalling and feedbacks from students or teachers which constitute interactive components of learning environment. The components are cognitive quantity which includes attention, efforts, determination, and time. Cognitive quality includes the use of learning strategies, concept gaining, curiosity, reflective ability, and collaboration (Halverson & Graham, 2019; Cohen, Carbone, & Beffa-Negrini, 2011; Garrison, Anderson, & Archer, 2001).

The students' concept gaining is closely related to the development of their thinking structure which is assumed as cognitive structure. This development is by finding information to solve problems, to make artefact by participating in group activities, and making arguments which indicate concept mastery (Olesova, Slavin, & Lim, 2016; DeNoyelles, Zydney, & Chen, 2014). Beach & Willows (2017)

explained that cognitive processes starts with the stages of planning, correlating thoughts and concepts, thinking, reflecting thoughts, and evaluating to obtain comprehension. Furthermore, the syntax of the RBLDT learning undergoes a series of processes, beginning with planning, collecting and using information, brainstorming ideas, and synthesizing creative ideas to be artefact (two or three dimensions) as well as evaluation.

#### 4.3. *The effect of the RBLDT learning model on students' digital literacy*

The results of the ANCOVA test (Table 11) showed that RBLDT learning model has an effect on digital literacy of students. In addition, the results of the post hoc LSD test showed that the digital literacy conducted by using the RBLDT learning model is significantly different. The average score using the RBLDT learning model is higher than those of the students taught by using the RBL learning and DT learning model (Table 12). Therefore, the implementation of RBLDT learning model improves digital literacy skills of students better than the RBL and DT learning models. Digital literacy is the ability to understand which is related to knowledge and technique that includes searching, finding, evaluating, and analyzing information from computer (Shubina & Kulakli, 2019; Shopova, 2014; Hobbs, 2011). According to Alvermann (2004), digital literacy involves interactive communication media and technology. Furthermore, it experiences some changes at any time in accordance with digital speed. This is very suitable to be implemented in learning by teachers.

The implementation of RBL learning model allows students to find literature from various sources. The most favourite learning sources for student in this 4.0 education era is digital approach. Therefore, the information search during the implementation of RBL learning model is digital information. Suntuasia et al. (2019) explained that this model can alter students' mindset or patterns of thoughts and show things they do not know. Therefore, it can improve the aspects of learning. In addition, at the implementation of DT learning model, the students are required to design their thinking structure to produce two or three dimension products. According to Lor (2017), design thinking is an innovative process which centers on human to create products which focuses on the users, service, or experience. To create the products, the students need to create information and arrange the information systematically. The searching process of information in the DT learning class is dominated with digital information. Meanwhile, the implementation of RBLDT learning model combines RBL and those of DT for students in information search. Similar findings were also reported by McGuinness & Fulton (2019) concerning the implementation of the right learning. This model improves digital literacy skills of students and allows them to adapt to digital development. Masitoh (2018) showed that the benefits of digital literacy are to deliver various information in social media and to support learning through the empowerment of students' analyzing and thinking skills about the information during the learning process.

The observation of digital literacy skills covers analyzing, synthesizing, comparing from various sources, presenting, evaluating and using information ethically. Marty, Alemanne, Mendenhall, Maurya, Southerland, Sampson, Douglas, Kazmer, Clark, & Schellinger (2013) reported that digital literacy skills can be empowered through the use of website to analyze and evaluate relevant information to be used. In addition, it can also be used to make presentation slides, to access table and graph and make quality scientific work. Moreover, other studies reported that digital literacy skills are closely related to critical thinking dimension to evaluate the right information sources and select the relevant information as well as to use the information critically (Kan'an, 2018; Marsh, 2016; Pangrazio, 2016; Buckingham, 2017).

The study by Melendres (2015) showed that the implementation of RBL learning model can empower the digital information literacy skills of students. This can develop their responsibility to find

learning information from the appropriate digital sources. Basically, the syntax of the model is to train the students to search, find, and use information. The combination of structured syntax is to improve the creative thinking skills which will have a better effect on students' digital literacy skills. Chan, Churchill, & Chiu (2017) explained that there are three levels of digital literacy development, which are digital competence, usage, and transformation. Digital competence consists of basic knowledge about concepts, basic techniques of operating software. Digital usage is the stages of solving problems using tools and creating products. Digital transformation is the learning experience and creativity development.

## 5. Conclusion

The results showed that RBLDT learning model improve creative thinking skills, concept gaining, and digital literacy of students in several high schools in Ambon. This learning model provides experiences to learn searching and finding information from various digital sources. Furthermore, it constructs the systematical thinking design to produce creative scientific products. The RBLDT learning model can also be applied by teachers to other biological concepts.

## 6. Recommendations

The results showed that the RBLDT learning model can be applied to other biological concepts. In addition, it can measure students' metacognitive abilities, critical thinking, and problem solving.

## Acknowledgments

This study is supported with a grant from Postgraduate, Pattimura University (Contract Number: 1565/UN13/SK/2019). Writer contributions: composing and designing research (DR), conducting research (DR, KS, MMB, SYK, VVK, CL), supervising research (DR), analyzing data and writing the article (DR, KS).

## References

- Afrianto. (2018). Being a professional teacher in the era of industrial revolution 4.0: Opportunities, challenges and strategies for innovative classroom practices. *English Language Teaching and Research*, 2(1), 1–13.
- Alvermann, D. (2004). Media, information communication technologies, and youth literacies. *The American Behavioural Scientist*, 48(1), 78–83.
- Anderson, N. (2013). Design thinking as a means of enhancing the creative and innovative abilities of undergraduate students when creating web based learning activities. In R. McBride & M. Searson (Eds.). *International Conference,. Proceedings of SITE 2013--Society for Information Technology & Teacher Education*, 4181–4186.
- Awang, H., & Ramly, I. (2008). Creative thinking skill approach through problem-based learning: pedagogy and practice in the engineering classroom. *International Scholarly and Scientific Research & Innovation*, 2(4), 334–339.
- Batlolona, J. F., Diantoro, M., Wartono, & Latifah, E. (2019). Creative thinking skills students in physics on solid material elasticity. *Journal of Turkish Science Education*, 16(1), 48–61.
- Beach, P., & Willows, D. (2017). Understanding teachers' cognitive processes during online professional learning: A methodological comparison. *Online Learning Journal*, 21(1), 60–84.
- Benjamin, A. J., White, M., MacKeracher, M., & Stella, K. (2013). The impact of globalization on adult education

- Rumahlatu, D., Sangur, K., Berhita, M.M., Kainama, S.Y., Kakisina, V.V., & Latupeirissa, C. (2021). Resource based learning design thinking (RBLDT): A learning model to improve students' creative thinking skills, concept gaining, and digital literacy. *Cypriot Journal of Educational Science*, 16(1), 288-302 <https://doi.org/10.18844/cjes.v16i1.5528>.
- in a have-not province. *Brock Education*, 22(2), 28–40.
- Birgili, B. (2015). Creative and critical thinking skills in problem-based learning environments. *Journal of Gifted Education and Creativity*, 2(2), 71–80.
- Buckingham, D. (2017). Digital media literacies: Rethinking media education in the age of the internet. *Research in Comparative and International Education*, 2(1), 43–55.
- Bustami, Y., Corebima, A. D., Suarsini, E., & Ibrohim. (2017). The social attitude empowerment of biology students: Implementation JiRQA learning strategy in different ethnics. *International Journal of Instruction*, 10(3), 15–30.
- Butler, M. (2012). Resource-based learning and course design: A brief theoretical overview and practical suggestions. *Law Library Journal*, 104(2), 2012–2019.
- Carpenter, S. K., & DeLosh, E. L. (2006). Impoverished cue support enhances subsequent retention: Support for the elaborative retrieval explanation of the testing effect. *Memory & Cognition*, 34, 268–276.
- Carroll, M. P. (2014). Shoot for the Moon! The mentors and the Middle Schoolers explore the intersection of design thinking and STEM. *Journal of Pre-College Engineering Education Research*, 14(1), 14–3.
- Chan, B. S. K., Churchill, D., & Chiu, T. K. F. (2017). Digital literacy learning in higher education through digital storytelling approach. *Journal of International Education Research*, 13(1), 1–16.
- Cheng, V. M. Y. (2010). Teaching creative thinking in regular science lessons: Potentials and obstacles of three. *Asia-Pacific Forum on Science Learning and Teaching*, 11(1), 1–21.
- Cohen, N. L., Carbone, E. T., & Beffa-Negrini, P. A. (2011). The design, implementation, and evaluation of online credit nutrition courses: A systematic review. *Journal of Nutrition Education and Behavior*, 43(2), 76–86.
- Cui, Y., Zhang, J., & Chen, Y. (2019). Research-based learning remodels the characters of undergraduates for creative and innovative personnel. *Advances in Social Science, Education and Humanities Research*, 36, 76–80.
- Darminto, B. P. (2013). Improving the ability of students' mathematical problem solving. *Jurnal Pendidikan Matematika Dan Sains*, 1(2), 101–107.
- DeNoyelles, A., Zydney, J. M., & Chen, B. (2014). Strategies for creating a community of inquiry through online asynchronous discussions. *MERLOT Journal of Online Learning and Teaching*, 10(1), 153–165.
- Dimitrov, D., & Rumrill, P. (2003). Pretest-posttest designs and measurement of change. *Work*, 20(2), 159–165.
- Gamar, M. M., Al Faruq, M. S., & Lina. (2018). Challenging the Indonesian primary education in industrial revolution 4.0 Era. *Advances in Social Science, Education and Humanities Research*, 269, 46–48.
- Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education*, 15(1), 7–23.
- Halverson, L. R., & Graham, C. R. (2019). Learner engagement in blended learning environments: A conceptual framework. *Online Learning Journal*, 23(2), 145–178.
- Hassi, L., & Laakso, M. (2011). Conceptions of design thinking in the design and management discourses open questions and possible directions for research. *Proceedings of IASDR2011, the 4th World Conference on Design Research, 31 October-4 November, Delft, the Netherlands*, 1–10.
- Hill, J. R., & Hannafin, M. J. (2001). Teaching and learning in digital environments: The resurgence of resource-based learning. *Education Technology Research Development*, 49(3), 37–52.
- Hobbs, R. (2011). Empowering learners with digital and media literacy. *Knowledge Quest*, 39(5), 12–17.

- Rumahlatu, D., Sangur, K., Berhitu, M.M., Kainama, S.Y., Kakisina, V.V., & Latupeirissa, C. (2021). Resource based learning design thinking (RBLDT): A learning model to improve students' creative thinking skills, concept gaining, and digital literacy. *Cypriot Journal of Educational Science*, 16(1), 288-302 <https://doi.org/10.18844/cjes.v16i1.5528>.
- Hussin, A. A. (2018). Education 4.0 made simple: Ideas for teaching. *International Journal of Education & Literacy Studies*, 6(3), 92–98.
- Istiyono, E., Dwandaru, W. B., & Rahayu, F. (2018). Pengembangan tes creative thinking skills fisika SMA (PhysCreTHOTS) berdasarkan teori tes modern [Development of a creative thinking skills test in Senior High School physics (PhysCreTHOTS) based on modern test theory]. *Cakrawala Pendidikan*, 37(2), 190-200. (In Indonesian).
- Jeon, Y. (2019). Problem-Solving Design-Platform model based on the methodological distinctiveness of service design. *Journal of Open Innovation: Technology Market Complexity*, 5(4), 1–15.
- Kacan, S. D., & Şahin, F. (2018). The impact of scientific creative thinking skills on scientific process skills. *SHS Web of Conferences*, 48(01060), 1–8.
- Kaeophanuek, S., Na-Songkhla, J., & Nilsook, P. (2019). A Learning process model to enhance digital literacy using Critical Inquiry Through Digital Storytelling (CIDST). *International Journal of Emerging Technologies in Learning*, 14(3), 22–37.
- Kan'an, A. (2018). The Relationship between Jordanian Students' 21st Century Skills (Cs21) and Academic Achievement in Science. *Journal of Turkish Science Education*, 15(2), 82–94.
- Karpicke, J. D. (2012). Retrieval-based learning: Active retrieval promotes meaningful learning. *Current Directions in Psychological Science*, 21(3), 157–163.
- Lase, D. (2019). Education and industrial revolution 4.0. *Handayani Journal*, 10(1), 48–62.
- Lor, R. R. (2017). Design thinking in education: A critical review of literature. *In Asian Conference on Education and Psychology*, 1–39.
- Lubart, T. (2016). Creativity and convergent thinking: Reflections, connections and practical considerations. *Journal of Psychology and Pedagogics*, 4, 7–15.
- Marsh, J. A. (2016). The digital literacy skills and competences of children of pre-school age. *Media Education*, 7(2), 197–214.
- Marty, P. F., Alemanne, N. D., Mendenhall, A., Maurya, M., Southerland, S. A., Sampson, V., Douglas, I., Kazmer, M. M., Clark, A., & Schellinger, J. (2013). Scientific inquiry, digital literacy, and mobile computing in informal learning environments. *Learning, Media and Technology*, 38(4), 407–428.
- Masitoh, S. (2018). Blended learning berwawasan literasi digital suatu upaya meningkatkan kualitas pembelajaran dan membangun generasi emas 2045. *Proceedings of the ICECRS*, 1(3), 13-34. (In Indonesian).
- McAuliffe, M. (2016). The potential benefits of divergent thinking and metacognitive skills in STEAM learning: A discussion paper. *International Journal of Innovation, Creativity and Change*, 2(3), 1–13.
- McGuinness, C., & Fulton, C. (2019). Digital literacy in higher education: A case study of student engagement with e-tutorials using blended learning. *Journal of Information Technology Education: Innovations in Practice*, 18, 1-28.
- Melendres, G. O. (2015). Resource-Based Learning (RBL) strategy to improve information literacy in general science of Freshmen Secondary Students. *Proceeding of the 3rd Global Summit on Education GSE 2015, 9-10 March 2015, Kuala Lumpur, Malaysia*.
- Miranti, M. G., & Wilujeng, B. Y. (2017). Creative thinking skills enhancement using mind mapping. *Advances in Social Science, Education and Humanities Research (ASSEHR)*, 112, 39–42.
- Noel, L. A., & Liub, T. L. (2017). Using design thinking to create a new education paradigm for elementary level children for higher student engagement and success. *Design and Technology Education: An International Journal*, 22(1), 1–12.

- Rumahlatu, D., Sangur, K., Berhita, M.M., Kainama, S.Y., Kakisina, V.V., & Latupeirissa, C. (2021). Resource based learning design thinking (RBLDT): A learning model to improve students' creative thinking skills, concept gaining, and digital literacy. *Cypriot Journal of Educational Science*, 16(1), 288-302 <https://doi.org/10.18844/cjes.v16i1.5528>.
- Nuswowati, M., & Taufiq, M. (2015). Developing creative thinking skills and creative attitude through problem based green vision chemistry environment learning. *Jurnal Pendidikan IPA Indonesia*, 4(2), 170-176.
- Olesova, L., Slavin, M., & Lim, J. (2016). Exploring the effect of scripted roles on cognitive presence in asynchronous online discussions. *Online Learning Journal*, 20(4), 34-53.
- Palinkas, L., Horwitz, S., Green, C., Wisdom, J., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health*, 42(5), 533-544.
- Palupi, B. S., Subiyantoro, S., Triyanto, & Rukayah. (2020). Creative-thinking skills in explanatory writing skills viewed from learning behaviour: A Mixed Method Case Study. *International Journal of Emerging Technologies in Learning*, 15(1), 200-211.
- Pangestuti, A. A., Mistianah, Corebima, A. D., & Zubaidah, S. (2015). Using reading-concept map-teams games tournament (Remap-TGT) to improve reading interest of tenth grade student of Laboratory Senior High School State University of Malang. *American Journal of Educational Research*, 3(2), 250-254.
- Pangrazio, L. (2016). Reconceptualising critical digital literacy. *Discourse: Studies in the Cultural Politics of Education*, 37(2), 163-174.
- Park, J. (2011). Scientific creativity in science education. *Journal of Baltic Science Education*, 10(3), 144-145.
- Rahardjanto, A., Husamah, & Fauzi, A. (2019). Hybrid-PjBL: Learning outcomes, creative thinking skills, and learning motivation of preservice teacher. *International Journal of Instruction*, 12(2), 179-192.
- Ritter, S. M., & Mostert, N. (2016). Enhancement of creative thinking skills using a cognitive-based creativity training. *Journal of Cognitive Enhancement*, 1, 243-253.
- Rumahlatu, D., Sangur, K., & Liline, S. (2020). The effect of complex instruction team product (CITP) learning model on increase student's skills. *International Journal of Instruction*, 13(1), 587-606.
- Scheer, A., Noweski, C., & Meinel, C. (2011). Transforming constructivist learning into action: Design thinking in education. *Design and Technology Education: An International Journal*, 17(3), 8-19.
- Scott, G., Leritz, L. E., & Mumford, M. D. (2004). The effectiveness of creativity training: A quantitative review. *Creativity Research Journal*, 16(4), 361-388.
- Seechaliao, T. (2017). Instructional strategies to support creativity and innovation in education. *Journal of Education and Learning*, 6(4), 201-208.
- Setiawati, H., & Corebima, A. D. (2018). Improving students' metacognitive skills through science learning by integrating PQ4R and TPS strategies at a Senior High School in Pare- pare, Indonesia. *Journal of Turkish Science Education*, 15(2), 95-106.
- Shahroom, A. A., & Hussin, N. (2018). Industrial revolution 4.0 and education. *International Journal of Academic Research in Business and Social Sciences*, 8(9), 314-319.
- Shaw, L., Maclsaac, J., & Singleton-Jackson, J. (2019). The efficacy of an online cognitive assessment tool for enhancing and improving student academic outcomes. *Online Learning Journal*, 23(2), 124-144.
- Shopova, T. (2014). Digital literacy of students and its improvement at the University. *Journal on Efficiency and Responsibility in Education and Science*, 7(2), 26-32.
- Shubina, I., & Kulakli, A. (2019). Pervasive learning and technology usage for creativity development in education. *International Journal of Emerging Technologies in Learning*, 14(1), 95-108.
- Sitorus, J., & Masrayati. (2016). Students' creative thinking process stages: Implementation of realistic mathematics education. *Thinking Skills and Creativity*, 22, 111-120.

- Rumahlatu, D., Sangur, K., Berhиту, M.M., Kainama, S.Y., Kakisina, V.V., & Latupeirissa, C. (2021). Resource based learning design thinking (RBLDT): A learning model to improve students' creative thinking skills, concept gaining, and digital literacy. *Cypriot Journal of Educational Science*, 16(1), 288-302 <https://doi.org/10.18844/cjes.v16i1.5528>.
- Sternberg, R. J. (2006). The nature of creativity. *Creativity Research Journal*, 18(1), 87–98.
- Stork, M. (2020). Supporting Twenty-First Century Competencies Using Robots and Digital Storytelling. *Journal of Formative Design in Learning*, 4, 43–50.
- Suartama, I. K., Setyosari, P., Sulthoni, & Ulfa, S. (2019). Development of an instructional design model for mobile blended learning in Higher Education. *International Journal of Emerging Technologies in Learning*, 14(16), 4–21.
- Suntusia, Dafik, & Hobri. (2019). The Effectiveness of research based learning in improving students' achievement in solving two-dimensional arithmetic sequence problems. *International Journal of Instruction*, 12(1), 17–32.
- Syarifah, H., Indriwati, S. E., & Corebima, A. D. (2016). Pengaruh strategi pembelajaran Reading Questioning And Answering (RQA) dipadu Think Pair Share (TPS) terhadap keterampilan metakognitif siswa laki-laki dan perempuan SMAN di Kota Malang [The effect of Reading Questioning And Answering (RQA) Integrated with. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, 1(5), 801-805. (In Indonesian).
- Trianggono, M. M. (2017). Analisis kausalitas pemahaman konsep dengan kemampuan berpikir kreatif siswa pada pemecahan masalah fisika [Causal analysing of students' concept gaining and creative thinking skills on physics problem-solving]. *Jurnal Pendidikan Fisika Dan Keilmuan*, 3(1), 1-12. (In Indonesian).
- Tu, J. C., Liu, L. X., & Wu, K. Y. (2018). Study on the learning effectiveness of stanford design thinking in integrated design education. *Sustainability*, 10(8), 1–21.
- Ummah, S. K., In'am, A., & Azmi, R. D. (2019). Creating manipulatives: Improving students' creativity through project-based learning. *Journal on Mathematics Education*, 10(1), 93–102.
- Wallner, T., & Wagner, G. (2016). Academic Education 4.0. *Proceeding International Conference on Education and New Developments*, 155–159.
- Yaniawati, P., Kariadinata, R., Sari, N., Pramiasih, E., & Mariani, M. (2020). Integration of e-learning for mathematics on resource-based learning: Increasing mathematical creative thinking and self-confidence. *International Journal of Emerging Technologies in Learning*, 15(6), 60–78.
- Zampetakis, L. A., Tsironis, L., & Moustakis, V. (2007). Creativity development in engineering education: The case of mind mapping. *Journal of Management Development*, 26(4), 370–380.
- Zubaidah, S. (2018). Keterampilan Abad Ke-21: Bagaimana membelajarkan dan mengasesnya [21st Century Skills: How to Learn it and Access it]. *Seminar Nasional Dengan Tema "Tantangan Biologi Dan Pendidikan Biologi Abad-21" Di Pendidikan Biologi FKIP Universitas Islam Riau*, 1-25. (In Indonesian).
- Zubaidah, S., Fuad, N. M., Mahanal, S., & Suarsini, E. (2017). Improving creative thinking skills of students through differentiated science inquiry integrated with mind map. *Journal of Turkish Science Education*, 14(4), 77–91.