

Analysis of Critical Thinking and Collaboration Skill Female Students Through Creative Problem Solving Model Assisted by Mind Map

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ABSTRACT

The 21st century learning requires students to have critical thinking skills to help solve problems and collaboration skills to support team learning. The aim of this study was to analyze the critical thinking and collaboration skills of female students in class XI MIPA MA Al-Amin Tasikmalaya through creative problem solving model learning assisted by mind map. This study employed a qualitative descriptive design and was conducted at MA Al-Amin Tasikmalaya during the 2023/2024 academic year with a saturated sample of 24 female students. The data analysis procedure followed Creswell's steps, which include organizing, coding, and interpreting meaning, with credibility checks using triangulation, member checking, in-depth description, and researcher reflexivity. The results showed that the critical thinking ability of female students through creative problem solving model learning assisted by mind map was in the high category with an average score of 76.93% while the collaboration ability was in the very good category with an average score of 86.6%. Thus, students of class XI MIPA MA Al-Amin Tasikmalaya already have good critical thinking and collaboration skills through learning creative problem solving models aided by mind maps.

Keywords: critical thinking ability, collaboration ability, creative problem solving model, mind map

INTRODUCTION

In the 21st century, the world is experiencing rapid changes in various fields. One of the most significant impacts of these changes has been observed in the field of education (Hasibuan & Prastowo, 2019). The field of education has undergone significant changes due to technological developments. In this century, education is systematically organized for better progress in the learning process so that students can understand, comprehend, and have a critical mindset. Therefore, learning in educational institutions should focus on 21st century skills (Rosnaeni, 2021).

Twenty-first-century learning encourages students to actively construct knowledge by accessing information from multiple reliable sources. According to Hadayani et al., (2020) stated

that in the teaching and learning process in the 21st century, students must have the qualities and abilities to compete in the global world. In order to be able to deal with it, students must be equipped with higher-order thinking skills, which is one of the abilities that students must have in the 21st century. One of the high-level thinking skills is critical thinking. Critical thinking is essential because it enables students to solve problems effectively and prepares them to face real-life challenges. Thus, critical thinking skills should be taught and applied to students throughout the learning process (Aditya Rahman et al., 2021). Apart from critical thinking skills, collaboration skills are also needed to support learning, because this ability implements team learning. According to Ahwan & Basuki (2023), learning with the ultimate goal of collaboration has several benefits, namely the use of efficient division of labour, increasing students' sense of responsibility, bringing together information and experience of viewpoints from various sources of knowledge, and increasing creativity and the quality of solutions that arise from the ideas of each group member.

In this century, teachers are also required to innovate in learning in order to achieve educational goals (Elitasari, 2022). According to Hulamiah (2023), the success of a teacher is not only measured by mastery of the material, but also by the ability to create an ideal learning environment. Therefore, teachers must have the ability to manage learning well. One aspect that can support a quality learning process is the selection of the right learning model. According to Asyafah (2019), learning models are an important part of learning. However, in using learning models, teachers need to make several considerations of a learning model.

In Indonesia, the education system faces the challenge of adapting to these needs. Although the national curriculum has covered some aspects of 21st century skills, its implementation still faces various obstacles, one of which is cultural differences in the application of learning models. One of the unique educational contexts in Indonesia is the existence of religious-based educational institutions (pesantren). In some educational institutions such as pesantren, class separation between boys and girls is carried out as part of an institutional policy rooted in cultural and religious values. According to Fauzan & Hafidz (2023), in achieving educational goals and producing quality graduates, each school strives to provide the best services and facilities, so that school models emerge that have their own characteristics and advantages, for example, learning models by grouping classes based on gender that separate male and female students. In line with this, according to Muflihin & Fatmawati (2023) stated that the separation of classes between male and female students aims to make students in the learning process more focused and also maintain the association between male and female students.

This educational context is consistent with the preliminary observations conducted by the researchers, it is known that learning with a separate class system between male students and female students is also implemented at MA Al-Amin Tasikmalaya school. In relation to this, based on the results of observations and interviews with Biology teachers in October to November 2023, it was found that although teachers have used 21st century learning models such as cooperative and discovery learning, the application is not optimal because sometimes

teachers still use conventional learning models that make students less active in the learning process. If the learning process is not developed, this can certainly affect the improvement of students abilities needed in the 21st century. Biology teachers also feel that students' critical thinking skills are still relatively low. This is felt during the learning process where it is still difficult for students to analysed a problem, find answers to questions posed by the teacher, especially questions related to real problems or in everyday life.

Based on the results of a preliminary study that provided questions on the human excretory system with an emphasis on critical thinking, it was found that the value of students' critical thinking skills gets an average value of 43.46. According to Suharyani & Siswanto (2022) the percentage value of students' critical thinking ability $0 < x \leq 43.75$ is categorised as very low. Therefore, based on the preliminary study results, it can be stated that the critical thinking ability of students at MA Al-Amin Tasikmalaya is classified as very low.

Another problem found is that the collaboration ability of students in working on assignments given by the teacher in groups is still less than optimal because sometimes students who work on group assignments are only one or two people in their group, while others have no response or provide ideas and some even just list their names without helping to do the task. The teacher also stated that when compared to female and male classes, female students tend to be more able to collaborate than male students. This is based on the learning process that requires group work, female students can be more open in discussing with each other and easier to build communication in teamwork. Despite this perception, there is not enough empirical evidence to support this view. Therefore, this study was conducted to find out more to understand whether there really is a difference in collaboration ability where female students tend to be more able to collaborate compared to male students.

Students critical thinking and collaboration skills need to be developed in the learning process. One of the efforts in developing learners' abilities is by changing the learning model to a learner-centred model. One of the models that can be applied is the creative problem solving model assisted by mind maps. According to Maharani et al. (2021) stated that the creative problem solving model is one of the many learning models that can improve students' critical thinking skills because it emphasises problem solving that uses students' creativity. In line with the statement from Ulhaq et al. (2023) this model can be concluded as a model that seeks to bring learners to think creatively when solving a problem that is openminded by paying attention to various important facts in building a variety of ideas and sorting out the best solution to implement originally. In its implementation, the application of the creative problem solving model can be assisted by a mind map. According to Kustian (2021), mind map is one of the learning media that uses instruments that can help map content or material so that it is easier to learn and analyse. Mind maps are designed to develop students' knowledge through creative activities by organizing the main ideas of a concept into a mind map that is easy for students to understand. Therefore, the integration of this mind map can make it easier for teachers to maximise the learning syntax of the creative problem solving model where students can easily

analyze and identify problems so that they can solve problems that occur around them by choosing the best solution as an action.

In this regard, the author sees an opportunity to teach creative problem solving models assisted by mind maps to students at school. This model is suitable for teaching biology material, one of which is excretory system material. Excretory system material was chosen as part of the focus of the research to be studied because this material is material that contains scientific issues and is quite complicated to be quickly understood because it discusses several detailed physiological processes of the human body and involves the interrelationship of several systems, such as the sensory system and respiratory system. Apart from this, the excretory system material was chosen because in its learning there are many cases that can be used as problems. The problems presented will help students process and train their thinking skills so that students can find solutions to these problems collaboratively.

Through the application of this model, the study is expected to make a practical contribution to the world of education by offering innovative alternative learning strategies for materials that are considered complex. Specifically, this study will provide empirical data on the analysis of the mind map assisted creative problem solving model in not only improving conceptual understanding but also simultaneously honing essential 21st century skills, namely critical thinking and collaboration. These results can serve as a reference for other educators in designing more student centered and problem solving oriented learning. Based on the description of the background of the problem, the author is interested in analysing the level of critical thinking skills and collaboration of students through the creative problem solving model assisted by mind map.

METHOD

This study employed a qualitative descriptive design. According to Creswell (2014), qualitative research is carried out in a natural setting, uses the researcher as the key instrument, involves multiple sources of data, and aims to understand participants meanings and experiences comprehensively. This design was chosen because the study aimed to analyze female students' critical thinking and collaboration skills through the implementation of the Creative Problem Solving model assisted by mind maps.

This research was conducted at MA Al - Amin Tasikmalaya in the 2023/2024 school year. The research subjects were female students of class XI MIPA, totaling 24 female students. Following the principles of qualitative sampling outlined by Creswell (2014), which emphasize purposeful sampling strategy over random selection to best understand the central phenomenon, a saturated sampling technique was applied to encompass all 24 female students in the specialized gender segregated class. The research instrument used was a critical thinking ability test in the form of an essay consisting of 18 items developed based on the critical thinking indicators proposed by Ennis (1985). For collaboration ability, the instrument used was a questionnaire consisting of 26 statements and an observation sheet consisting of 12 statements developed according to the indicators according to Trilling & Fadel (2009). After that, interviews

were conducted to prove or strengthen the results of tests, questionnaires and observation sheets that had been given so that information about critical thinking and collaboration skills became more in-depth. The data analysis procedures followed Creswell's qualitative data analysis steps, including organizing and preparing the data, reading all data, coding the data, developing descriptions and themes, representing the findings, and interpreting the meaning of the findings. To ensure the credibility of the findings, this study applied triangulation, member checking, rich and thick description, and researcher reflexivity. The criteria used to categorise the test results of critical thinking skills in this study can be seen in table 1 below.

Table 1. Critical thinking ability criteria

Criteria	Interval
Very High	$81.25\% < x \leq 100\%$
High	$71.5\% < x \leq 81.25\%$
Medium	$62.5\% < x \leq 71.5\%$
Low	$43.75\% < x \leq 62.5\%$
Very Low	$0\% < x \leq 43.75\%$

Source: Suharyani & Siswanto (2022)

While the criteria for categorising the results of questionnaires and observation sheets of collaboration skills in this study can be seen in table 2 below.

Table 2. Collaboration ability criteria

Criteria	Interval
Very Good	86% - 100%
Good	76% - 85%
Fair	60% - 75%
Less	55 - 59%
Very Less	$\leq 54\%$

Source: Purwanto (in Devi et al., 2023)

RESULT AND DISCUSSION

Critical Thinking Ability

The critical thinking ability of female students was measured using an essay question test. The results of the critical thinking ability test are categorised into five criteria, namely very high, high, medium, low, and very low. The interpretation results can be seen in Table 3 below.

Table 3. Interpretation of critical thinking ability test results

Interval	Criteria	Total of Female Students	Percentage	Class Mean
$81.25\% < x \leq 100\%$	Very High	12	50%	42.13
$71.5\% < x \leq 81.25\%$	High	7	29.17%	
$62.5\% < x \leq 71.5\%$	Medium	4	16.67%	

Interval	Criteria	Total of Female Students	Percentage	Class Mean
$43.75\% < x \leq 62.5\%$	Low	1	4.16%	
$0\% < x \leq 43.75\%$	Very Low	0	0%	
Total		24	100%	

Source: Data processed results

To see the results of the critical thinking ability test on each indicator, it can be seen in Figure 1 below.

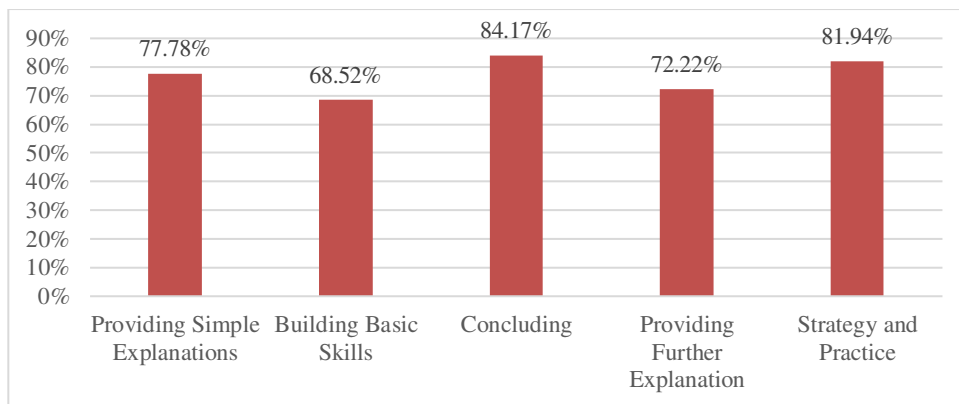


Figure 1. Test result data for each critical thinking ability indicator

Source: Data processed results

Based on Figure 1 above, it shows the test result data for each indicator of critical thinking ability which consists of five indicators according to Robert H. Ennis (1985), including providing simple explanations, building basic skills, concluding, providing further explanation, and strategies and practice. The number of questions used in critical thinking skills is 18 questions. It is known that each indicator has a different average value, where the highest value in critical thinking ability is in the conclusion indicator of 84.17% with a very high level of achievement. In line with the results of the interview, most students have been able to understand the material of the excretory system which makes them able to make induction, deduction, and consider the results of the decisions they make. They are able to explain the organs of the excretory system and their functions and conclude from the problem articles presented. This finding may be attributed to the implementation of the Mind Map-Assisted Creative Problem Solving model. During the idea-finding stage, students were encouraged to draw conclusions from the collected evidence, generate creative ideas, and propose innovative solutions to the problems presented. During the solution-finding stage, students evaluated alternative solutions based on predefined criteria to identify the most appropriate solution. Mind maps also facilitated the organization and integration of information, enabling students to recognize relationships among concepts and draw more accurate conclusions. According to Asmawati et al., 2018 during the learning process using the creative problem solving model, students not only listen and take notes, but can express opinions, ask friends during discussions, and other activities so that students can use various

ways with their creative power to solve a problem. This is in line with the opinion of Yulita & Amini (2020) that the creative problem solving model makes students more active and able to think critically in following lessons that can improve material understanding for students.

The lowest score was obtained for the basic skills indicator (68.52%), which was categorized as moderate. In line with the results of the interview, where students have been able to observe and consider the results of observations of the problems presented. This is because students have gone through the learning process using the creative problem solving model assisted by mind maps which allows them to achieve this ability, where at the objective finding stage, students are trained to observe and collect data in determining the situation and conditions of a problem presented. At the fact finding stage, students are trained to evaluate the sources of information used. They must check whether the sources used are reliable and whether there is supporting evidence to be used as valid and relevant information. Mind maps also helped students organize factual information systematically, thereby supporting the development of fundamental analytical skills. However, most schoolgirls have not been able to determine the credibility of information. This is because students have not been directed and given an understanding of the credibility of a source. Whereas according to the opinion of Warsita et al., (2018) states that the ability to determine the credibility of a source is one of the important components in the critical thinking process. However, determining the credibility of a source is a complex matter so that more effort is needed in creating a learning process that can lead students to be more familiar with the ability to determine the credibility of an information source. This is in line with the research of Adinda et al., (2022) that the results of the study showed an average score of 56.94 where students could only give their agreement or opinion but were less able to provide reasons for their opinion to support the opinion they had given.

Overall, the participants demonstrated a high level of critical thinking skills, with a mean score of 76.93%. That is, it can be seen that students of class XI MIPA MA Al-Amin Tasikmalaya already have critical thinking skills where students have been able to analyse information in depth, observe and consider the results of observations, draw conclusions, and can make actions that interact with others about the importance of maintaining the organs of the excretory system. This is also because students have gone through the learning process using the creative problem solving model assisted by mind maps which allows them to achieve high critical thinking skills and the existence of mind maps in helping to visualise information and ideas to support the critical thinking process. However, some students still cannot analyse arguments, analyse assumptions, consider a decision, decide on an action, and consider the credibility of a source, which makes the students' critical thinking skills need to be improved.

To improve critical thinking skills, the creative problem solving model assisted by mind maps needs to be further developed at the problem finding and solution finding stages. At the problem finding stage, it is important to be developed in involving students in finding problems more deeply. In addition, at the solution finding stage, it is necessary to emphasise skills in finding various effective solutions together, as well as assessing these solutions based on facts and strong arguments. In this model, mind maps also need to be developed in visualising various

problems that may be faced by graphically recording ideas that are clearly arranged, starting from the main idea in the middle and branches for supporting ideas. This will help students understand the relationship between various concepts and information.

Collaboration Ability

The collaboration ability of female students was measured using questionnaires and observation sheets. The results of the collaboration ability questionnaire are categorised into five criteria, namely very good, good, sufficient, less, and very less. The interpretation results can be seen in Table 4 below.

Table 4. Interpretation of collaboration ability questionnaire results

Interval	Criteria	Total of Female Students	Percentage	Class Mean
86% - 100%	Very Good	10	41.67%	88.29
76% - 85%	Good	10	54.17%	
60% - 75%	Fair	1	4.16%	
55% - 59%	Less	0	0%	
≤ 54%	Very Less	0	0%	
Total		24	100%	

Source: Data processed results

To see the results of the collaboration ability questionnaire on each indicator, it can be seen in Figure 2 below.

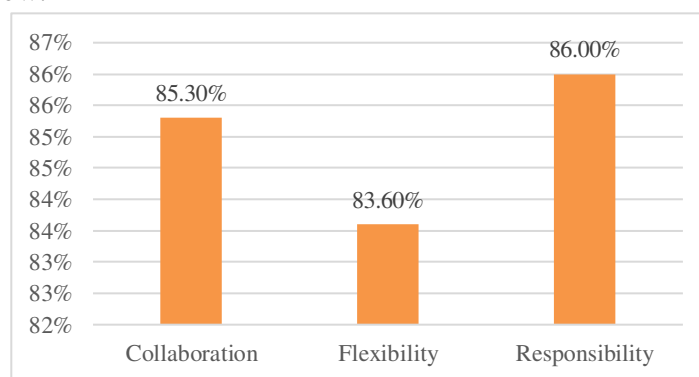


Figure 2. Questionnaire results data for each indicator of collaboration ability

Source: Data processed results

The observation results of collaboration skills are also categorised into five criteria, namely very good, good, sufficient, less, and very less. The interpretation results can be seen in table 5 below.

Table 5. Interpretation of observation results of collaboration skills

Interval	Criteria	Total of Female Students	Percentage	Class Mean
86% - 100%	Very Good	18	75.00%	21.17
76% - 85%	Good	2	8.34%	
60% - 75%	Fair	1	4.16%	
55% - 59%	Less	0	0.00%	
≤ 54%	Very Less	3	12.5%	
Total		24	100%	

Source: Data processed results

To see the results of the collaboration ability observation sheet on each indicator, it can be seen in Figure 3 below.

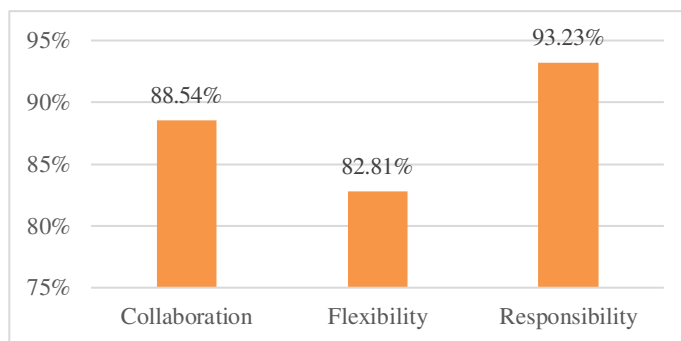


Figure 3. Observation data of each indicator of collaboration ability

Source: Data processed results

Based on Figure 2 and Figure 3 above shows the data from the questionnaire and observation sheet for each indicator of collaboration ability which consists of three indicators according to Trilling & Fadel (2009), including collaboration, flexibility, and responsibility. The number of questionnaires used in collaboration skills is 26 statements and the number of observation sheets is 12 statements. It is known that each indicator has a different average value, where the highest value in collaboration ability is in the responsibility indicator, obtained a collaboration ability questionnaire score of 86% with a very good category and an observation sheet of 93.23% with a very good category. In line with the results of the interview, the students already have a sense of responsibility for their respective tasks because they revealed that if there is no sense of responsibility, they will lose the results of the task that must be completed. During the learning process in class, it can be seen that each group member is able to take responsibility by participating in discussions, can cooperate with their group, and can appreciate the contribution of each group member. So, a sense of responsibility in collaboration can be seen from how someone carries out tasks, communicates with the team, supports their group mates,

and how they view shared responsibility in the success or failure of the group. A responsible person will be actively involved in the entire collaboration process and committed to ensuring a positive end result for the group. This is reinforced by Haris (2017) who states that students learn collaboratively but each student has the responsibility to complete the tasks that have been given and is responsible for helping their group mates, this individual responsibility is what makes each student feel concerned about fellow group members, the success of the group, and ultimately the attitude of responsibility. Mind maps facilitated collaborative work by making each member's contribution more visible throughout the learning process. Each group member contributed ideas, while the completed mind map reflected their collective responsibility. Consequently, the use of mind maps promoted a stronger sense of collective responsibility in achieving common learning goals.

While the acquisition of the lowest value is in the flexibility indicator, the collaboration ability questionnaire score is 83.6% with a good category and the observation sheet is 82.81% with a good category. This is in line with the interview of female students where they like to discuss in advance with group friends when choosing an action in doing the task, able to provide ideas and solutions in solving group task problems and able to adapt and work effectively in different situations. During the learning process in class, it can be seen that each group member is able to complete their group assignments where each group member gives an opinion about the problems and solutions that are done and is able to appreciate the answers of their groupmates. In this process, mind maps facilitated collaboration by allowing students to exchange ideas, provide feedback, and expand one another's understanding. This process shows a willingness to help, especially when there are members who may have difficulty conveying their ideas or tidying up concepts. This is in line with the opinion according to Anggelita & Mariono (2020) which states that in this century, collaboration is not only important, but also required by everyone. Therefore, students' collaboration skills can be further improved.

However, around 20% of female students were still reluctant to respond to their friends who asked for help during group activities in finding answers to questions that had to be included in the mind map. They prioritize their own tasks to be completed rather than helping their friends when asking for help. After the task was completed, they helped the friend who asked for help. This does not mean that the students showed a lack of flexibility, but it is necessary to consider the context and how the decision was made. However, flexibility also requires being open to other people's situations, communicating well, and finding a balance between completing tasks and helping friends. According to Firman et al., (2023) stated that thinking flexibility in students is able to apply various knowledge possessed to solve new problems that are rarely known, flexibility is very important for students to have in solving problems. According to Balqist et al., (2019) the difference in achievement in students' collaboration skills is due to the learning process requiring students to be able to solve a problem by discussing with their group members.

Thus, the overall collaboration ability of female students has an average score of 86.6% with a very good category. This means that it can be seen that students of class XI MIPA MA Al-Amin Tasikmalaya have an awareness of the importance of working together, flexibility, and

responsibility for the tasks they have to complete. This is also because the students have gone through a learning process using a creative problem solving model assisted by a mind map that allows collaboration to show how cooperation can produce more creative and effective solutions. The Creative Problem Solving model facilitated active participation, encouraged diverse perspectives, supported shared decision-making, and strengthened collaborative problem-solving skills. Collaboration in this model can also build good communication, mutual respect, and joint responsibility for the results of the tasks undertaken.

However, this ability needs to be further improved again because there are still around 20% of female students who are unable to collaborate well, especially during the idea finding stage of learning, where they still have not maximally contributed to providing ideas or solutions to the problems presented. When making mind maps collaboratively, group members have the opportunity to share different views and ideas. Through this process, group members will learn to work together, respect different opinions, and take joint responsibility for solving the problems presented.

CONCLUSION

Based on the discussion and analysis results that have been presented, it can be concluded that the level of critical thinking ability through the creative problem solving learning model assisted by mind map owned by XI MIPA MA Al-Amin Tasikmalaya class students is in the high category with an average score of 76.93%. The highest critical thinking indicator is in the conclusion indicator, with a score of 84.17% which is in the very high category. This is shown when learning using the creative problem solving model assisted by mind map, most students have been able to draw conclusions well based on the problems given to produce logical decisions. Conversely, the lowest critical thinking indicator is on building basic skills with a score of 68.52% which is in the medium category. These findings indicate that some students still require additional support in strengthening their foundational analytical skills before progressing to higher-order critical thinking.

As for collaboration ability, it is in the very good category with an average score of 86.6%. The highest collaboration indicator is responsibility, with a collaboration ability questionnaire score of 86% and an observation sheet of 93.23%, both of which are in the very good category. This shows that during learning using the creative problem solving model assisted by mind maps, students have been able to work well together and take full responsibility for their role in the group. However, the flexibility indicator received the lowest score, which was 83.6% in the questionnaire and 82.81% in the observation sheet in the good category. This low score may be due to limitations in the ability to adapt to changes in situations or ideas from group members, as well as the tendency to focus more on completing individual tasks without optimally considering the needs or opinions of others.

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