



The Effect of Emotional Intelligence on Science Learning Outcomes in Students Given Associational and Conventional Multiple-Choice Tests

Supriyadi^{1*}

¹Fakultas Ilmu Pendidikan, Universitas Panca Sakti Bekasi, Jawa Barat, Indonesia.

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Corresponding Author:

Supriyadi

supriyadi@unram.ac.id

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Abstract: This study aims to reveal the effect of emotional intelligence (X1) on science learning outcomes (Y) in students who are given multiple choice association tests and conventional multiple-choice tests (X2). The research method used is the experimental method. The population in this study was class IX students at MTs Negeri 7 Model Jakarta. The sampling technique uses cluster random sampling. The research sample consisted of 60 students divided into students who have high and low emotional intelligence. The results of the research instrument trials showed that the reliability of the science learning outcomes instrument in the form of an association multiple choice test was 0.701 and the reliability of the science learning outcomes instrument in the form of conventional multiple-choice tests was 0.827, and emotional intelligence was 0.782. The data analysis used is a two-way ANOVA. The results of the study revealed: (1) The science learning outcomes of students who were given multiple-choice tests of association were higher than those who were given conventional multiple-choice tests. (2) There is an interaction between the form of the test and emotional intelligence on students' science learning outcomes. (3) For students who have high emotional intelligence, the science learning outcomes of students who are given the multiple-choice test form of association are higher than those who are given the conventional multiple choice test form. (4) For students who have low emotional intelligence, the science learning outcomes of students who are given a conventional multiple-choice test are higher than those who are given an association multiple-choice test.

Keywords: Association Multiple Choice Test; Conventional Multiple-Choice Test; Emotional intelligence; Science Learning Outcomes

Introduction

Developments in the field of education, especially in schools have begun. For example, the use of IT (information technology) with the emergence of e-learning and e-school (Mautso & Goosen, 2023). The learning process carried out through IT, the results are guaranteed to be superior because the formulation of learning patterns has been made more flexible according to the needs of students. Thus, students who take part in teaching and learning activities do not experience saturation with the innovations that the teacher applies in every learning activity (Pangestu & Karwan, 2021). A person is declared to be carrying out learning activities

when there is a change in behavior, for example from not knowing to knowing, and not understanding to understanding. Changes in behavior, changes in knowledge, values and attitudes, the results can be learning objectives. By knowing the level of achievement of learning objectives, teachers can take action to improve learning or provide guidance for their students both classically and individually. So that students also feel cared for, especially students who have weaknesses in certain subject areas so that the learning outcomes obtained are better.

Assessment of learning outcomes uses various assessment methods and techniques according to learning objectives, in general the assessment techniques

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used in schools are written tests used as formative tests or summative tests (Bacquet, 2020; Bin Mubayrik, 2020). That certain learning objectives and experiences may be quite effective in being assessed through written tests (paper-pencil tests), while other learning objectives and experiences are effectively assessed by practical tests (Muslich, 2011). The assessment through written tests is carried out to reveal students' mastery in cognitive aspects/realms starting from the level of knowledge, understanding, application, analysis, synthesis, to evaluation. In addition, the tests given to students sometimes also refer to the competencies being assessed, so that the tests used are able to measure students' abilities (Adom et al., 2020; McClelland, 1973). Through tests the teacher can obtain information about the success or failure of students in mastering the objectives (competence standards, basic competencies and indicators) that have been set in the curriculum. Through tests the teacher can easily detect students who have mastered or have not mastered the material. In addition, the test can also be used by the teacher to detect the success or failure of the learning that has been carried out (Abdulrahman et al., 2020; López-Pernas et al., 2019). Another important aspect that determines the success of the evaluation of educational outcomes is the measurement technique.

Measurement is an activity to obtain information quantitatively or in other words is a procedure for determining student scores or determining the value of an object or the price of an object, and to be able to determine a value or price of an object requires a size or criteria (Ariyanti & Bhakti, 2020). The activity of measuring the properties of an object is an activity of determining the quantity of properties of an object through certain rules obtained that truly represent the properties of the object in question, and in measurement the process of determining numbers for individuals or determining individual characteristics according to certain rules the result of which is in the form of quantitative data (Agusminarti et al., 2021).

Measurement using a measuring instrument in the form of a written test must use a variety of test forms that can hone students' thinking skills to become more critical, for example the teacher can modify the form of a multiple-choice test to become multiple choice association, multiple choice causation, match test form, true-test form, false and so on. The information provided by multiple choice tests is richer, meaning that these items can provide more information about students to teachers or other test compilers, especially if these items have high homogeneity (Mutiah et al., 2020; Putri, 2020). The form of multiple-choice tests commonly used by teachers is the usual or conventional multiple-choice form, in which students can choose the most appropriate answer from several alternative answers (Chen et al.,

2020; Collignon et al., 2020; McKenna, 2019; Shin et al., 2019).

The reason teachers rarely modify test forms is the limited time to make questions with various forms, and teachers find it difficult to make other forms of multiple-choice tests such as multiple choice associations, or multiple choice causation (Brassil & Couch, 2019; Zhao et al., 2023). Even though the association or complex multiple-choice model can make students able to think critically (Stringer et al., 2021), where in answering the questions students don't just guess the correct answer, and students are more familiar with seeing modified multiple choice forms, so that when students take the college entrance test or olympic championships students are familiar with the various forms of multiple choice tests. In fact, the teacher prefers to use the form of a description test or the usual multiple choice form, even though the teacher must use valid and reliable questions to measure students' cognitive abilities. One form that can be developed is the multiple-choice association test.

When the teacher chooses the form of the test in the field of study he teaches, the teacher should be able to adjust to the classroom conditions (Andrade & Brookhart, 2020), including the existence of individual student differences, such as differences in intellectual abilities or intelligence (IQ), and other differences. In response to this, teachers are expected to have the right initiatives and strategies in teaching, especially in the use of the latest forms of tests that are innovative, so that this activity can add to the teacher's knowledge and experience in teaching. In education, we recognize two kinds of factors that influence students and play a major role in student achievement in learning, namely *external factors*, namely factors that come from outside the student, such as family, school and social environment; and *internal factors*, namely factors that come from within the student, such as motivation, attitude, and IQ. These factors support each other and play a major role in the behavior and intellectual abilities of students in learning.

However, we are more inclined to assume that the IQ factor is the dominant factor influencing student achievement internally (Bimayu et al., 2020). We tend to assume that students who have a high IQ perform better than students who have a low IQ, and vice versa. In some cases of learning at school it turns out that this assumption is not always true, because it can happen that a student who has a high IQ gets low learning achievement. Of course, this case raises the question: "Why do students who have high IQ get low learning achievement?" In this case, many experts state that the internal factors that influence the success of individual students in learning are not only influenced by IQ but also influenced by emotional intelligence (Emotional Intelligence).

Emotional intelligence is currently a special concern of educational experts and practitioners, because emotional intelligence is also believed to be one of the internal factors that influence student success in learning, besides IQ (Farhan & Alfin, 2019). Differences in the level of students' emotional intelligence are believed to greatly influence student differences in how to solve problems in learning, especially those concerning problems in self-control, enthusiasm, perseverance, and the ability to motivate oneself. It can be said that the level of emotional intelligence of students has a dominant influence on the condition of students in learning. Emotional intelligence as a group of mental abilities that help you recognize and understand your feelings and the feelings of others, which leads to the ability to regulate your feelings (Estrada et al., 2021; Norboevich, 2020). There are two sides to emotional intelligence: it requires your intelligence to understand emotions, and it requires your emotional (feeling) mind to add creativity and intuition to your logical thinking.

Emotional intelligence is a person's ability to manage his emotional life with intelligence (to manage our emotional life with intelligence); maintaining emotional alignment and expressing it (the appropriateness of emotion and its expression) through self-awareness, self-motivation, empathy, and social skills (Gómez-Leal et al., 2022). If individuals have high emotional intelligence, it will give birth to high social sensitivity, and have the ability to adapt in all forms of conditions. Not many schools try to test their students' emotional intelligence. Many schools only focus on measuring student intelligence, while measuring student emotional intelligence is often ignored, even though measuring student emotional intelligence is also very necessary, because with measurements of emotional intelligence the school, especially teachers, will be able to find out the level of emotional intelligence possessed by their students, so that teachers can get to know the personal concerns of their students' emotions better. By knowing the level of students' emotional intelligence, it will help teachers in learning, especially in dealing with cases of learning difficulties faced by students caused by student internal factors. This is intended so that individual student abilities can be developed optimally for better achievement in learning.

Method

This study aims to reveal the effect of emotional intelligence (X1) on science learning outcomes (Y) in students who are given multiple choice association tests and conventional multiple-choice tests (X2). The research method used is the experimental method. The population in this study was class IX students at MTs Negeri 7 Model Jakarta. The sampling technique uses

cluster random sampling. The research sample consisted of 60 students divided into students who have high and low emotional intelligence. The results of the research instrument trials showed that the reliability of the science learning outcomes instrument in the form of an association multiple choice test was 0.701 and the reliability of the science learning outcomes instrument in the form of conventional multiple-choice tests was 0.827, and emotional intelligence was 0.782. The data analysis used is a two-way ANOVA. The research method used in this study is the experimental method. Experimental research is research that is intended to find out whether there is an effect of "something" imposed on the investigated subject (Arikunto, 2013). In other words, experimental research tries to examine whether there is a causal relationship or not. The trick is to compare one or more experimental groups that were given treatment with one or more comparison groups that did not receive treatment. Christensen (2006: 103) in an experimental psychology book defines research design as a plan or strategy used to answer a research problem. In this study, a 2 X 2 factorial design was used in the hope of showing the effectiveness of the treatment more carefully. The research design chart shown in Table 1.

Table 1. Design Factorial 2 X 2

A \ B	Association Multiple Choice Test A1	Conventional Multiple-Choice Test A2	Σb
High Emotional B1	(A1B1) Y11	(A2B1) Y21	Y.1
Low Emotional B2	(A1B2) Y12	(A2B2) Y22	Y.2
Σk	Y1.	Y2.	Y..

- Information:
- A1B1 (Y11) : The value of science lessons for students who have high emotional intelligence, who are given multiple choice association tests.
 - A2B1 (Y21) : The value of science lessons for students who have high emotional intelligence, who are taught using conventional multiple choice tests.
 - A1B2 (Y12) : Science grades of students who have low emotional intelligence, who are given multiple choice association tests.
 - A2B2 (Y22) : The value of science lessons for students who have low emotional intelligence, who are given conventional multiple choice tests.
 - Y.1 : The value of science lessons for students who have high emotional intelligence.
 - Y.2 : The value of science lessons for students who have low emotional intelligence.
 - Y1. : Science grades of students who are given multiple choice association tests.
 - Y2. : The value of students' science lessons given a conventional multiple-choice test.
 - Y.. : Overall results of science students.

Result and Discussion

The student learning outcomes scores given the association multiple choice test have a mean of 84.90 with a standard deviation of 8.99, while the group learning outcomes scores given the conventional multiple-choice test have a mean of 80.30 with a standard deviation of 5.92. These data indicate that the learning outcomes scores of the group of students given multiple choice tests Multiple association scores are higher than student learning outcomes scores given conventional multiple-choice tests.

The score for the group of students who have high emotional intelligence has a mean of 85.10 with a standard deviation of 8.92, while the score for the group of students who have low emotional intelligence has a mean of 80.10 with a standard deviation of 5.78. These data show that the score for the group of students who have emotional intelligence high is higher than the score of student learning outcomes that have low emotional intelligence.

The score for the group of students who have high emotional intelligence given the multiple choice association test has a mean of 92.20 with a standard deviation of 4.97, while the score for the group of students who have high emotional intelligence who is given a conventional multiple choice test has a mean of 78.00 with a standard deviation of 5.66, Data This shows that the learning outcomes scores of students who have high emotional intelligence who are given multiple choice tests of association, are higher than the learning outcomes scores of students who have high emotional intelligence who are given conventional multiple choice tests. The learning outcomes scores of groups of students who have low emotional intelligence who are given multiple choice association tests have a mean of 77.50 with a standard deviation of 5.13, while the learning outcomes scores of groups of students who have low emotional intelligence who are given conventional multiple-choice tests have a mean of 80.80 with a standard deviation of 5.37. These data shows that the learning outcomes scores of students who have low emotional intelligence who are given multiple choice tests of association, are lower than the learning outcomes scores of students who have low emotional intelligence who are given conventional multiple-choice tests.

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Data Normality Test

The data normality test for research data uses the Lilliefors test in Table 2. It is known that the Lo of the six data groups is lower than the value of Lt at a significance level of $\alpha = 0.05$. This shows that the six groups of data are normally distributed.

Table 2. Summary of Data Normality Test results

Group	N	Price		Conclusion
		Lo	Lt	
PGA	30	0.114	0.161	Normal
PGK	30	0.127	0.161	Normal
KET	30	0.115	0.161	Normal
KER	30	0.131	0.161	Normal
PGAKET	15	0.127	0.22	Normal
PGKKET	15	0.193	0.22	Normal
PGAKER	15	0.202	0.22	Normal
PGKKER	15	0.074	0.22	Normal

Data Homogeneity Test

The homogeneity test for research data uses the Bartlett test. From the calculation results, the value of χ count is $0.267 < \chi$ table 7.815 at a significance level of $\alpha = 0.05$, then H_0 is accepted, this means that the variations in the four experimental groups are homogeneous.

Hypothesis test

From the results of data analysis using two-way ANOVA. From the Table 3 shows that $F_{count} > F_{table}$ or H_0 is rejected. With $F_{count} 11.027 > F_{table} 4.01$ at a significant level $\alpha = 0.05$; $F_{table} 7.11$ at a significant level $\alpha = 0.01$. Thus, there is a difference in the average science

learning outcomes between students who are given association and conventional multiple-choice tests. This shows that the learning method has a very significant effect on the science learning outcomes of students who are given a multiple-choice association test which is higher than the scores of students who are given a conventional multiple-choice test. Thus, the first hypothesis in this study can be accepted. To find out that there is a very significant difference in learning outcomes between groups of students who are given multiple-choice tests of association with groups of students who are given conventional multiple-choice tests.

Table 3. Two-way Anava to Hypothesis Test

Variance of Source	db	JK	RJK	F count	F table	
					0.05	0.01
Fellow A	1	3.0827	3.0827	11.027**	4.01	7.11
Fellow B	1	3.7500	3.7500	13.415**	4.01	7.11
Interaction A X B	1	14.0167	14.0167	50.141**	4.01	7.11
In	56	15.6547	0.2795			
Total	59	36.5040				

Note :
 * : Signifikan
 ** : Very significant

$F_{count} > F_{table}$ or H_0 is rejected. With $F_{count} 50.141 > F_{table} 4.01$ at a significant level $\alpha = 0.05$; $F_{table} 7.11$ at a significant level $\alpha = 0.01$. means that there is a very significant interaction effect between factor A (multiple choice test form) and factor B (Emotional Intelligence) or the effect of multiple-choice test forms on learning outcomes depending on emotional intelligence. This shows that there is a very significant difference in interaction due to the form of multiple-choice tests and students' emotional intelligence on students' overall science learning outcomes. Thus, the second hypothesis of this study can be accepted. Because there are interactions and differences in learning outcomes between groups, further hypothesis testing is carried out using the t-dunet test.

From the results of further tests using the t-Dunnet test, it is obtained $t_{cont} = 7.355 > t_{table} = 2.003$, then H_0 is rejected. Thus, the science learning outcomes of the group of students who were given the multiple-choice association test were higher than the group of students who were given the conventional multiple-choice test in the group of students who had high emotional intelligence. So that the third hypothesis in this study can be accepted.

The results of the follow-up test using the t-dunnet test obtained this = $-2.659 < t_{table} = 0.063$, then H_0 is accepted. Thus, the science learning outcomes of the group of students who were given multiple choice tests of association were lower than the group of students who were given conventional multiple-choice tests in

groups of students who had low emotional intelligence. So, the fourth hypothesis in this study can be accepted.

From the results of testing the research hypothesis, it shows that all the working hypotheses of this study can be accepted. In the first hypothesis, the science learning outcomes of students who were given multiple-choice tests of association were higher than those of students who were given conventional multiple-choice tests. This is in line with the opinion which states that different forms of tests cause test takers to work with different analytical techniques, so that they can affect the reliability coefficient (Sarea & Ruslan, 2019). The form of the multiple choice test shows that the assessment is carried out objectively, and the test time used is more efficient when compared to the essay form so that it affects the reliability coefficient, besides that students are required to analyze questions and think critically. That in order to have critical thinking, one must be trained with multiple choice items which can not only find the truth but must be followed by an approach that leads to finding the truth, by using modifications to the multiple choice items. Multiple choices such as analysis of a case, pictures, tables, maps or caricatures, or multiple choice items with answers chosen by students must be accompanied by explanations or reasons. the rules in this case the teacher does not carelessly give numbers to the results of student answers (Ariyanti & Bhakti, 2020).

Thus, there is a difference in the average reliability coefficient between multiple choice test forms and

scoring techniques. This is reinforced apart from the scoring factor, several other factors that need to be considered in relation to the stability of the reliability coefficient, include: (1) sample size, (2) variation within the respondent group, and (3) differences reliability estimation method. The multiple choice tests have several advantages, namely, easy to assess, objective scores, easy item analysis, and high reliability.

In the second hypothesis of the study there is an interaction between the form of multiple choice tests and the level of students' emotional intelligence on science learning outcomes. Based on the results of the study it was found that the form of multiple choice tests and students' emotional intelligence also influenced students' science learning outcomes, namely students who had high emotional intelligence were more suitable to be given multiple choice tests of association, while students who had low emotional intelligence were more suitable to be given conventional multiple choice tests. Choosing the right form of multiple-choice test by the teacher in the learning process in terms of differences in students' emotional intelligence, greatly determines the level of success of students in learning, because if the wrong form of multiple-choice test is chosen by the teacher, it will cause students to not be able to learn optimally.

The research hypothesis stated that in the group of students who had high emotional intelligence, the science learning outcomes of students who were given multiple-choice tests of association were higher than students who were given conventional multiple-choice tests. Based on the results of the study, students who had high emotional intelligence found that the scores of students who were given multiple-choice association tests in science were higher than the scores of students who were given conventional multiple-choice tests. This is because students who have high emotional intelligence, have a better response in doing tests in the form of multiple choice association tests. This is because students who have high emotional intelligence have the ability to control and manage their emotions better when doing multiple choice tests, they have high awareness, are able to control themselves, are able to motivate themselves, have empathy or attention to learning, and are able to place in class as a good student.

In learning students who have high emotional intelligence tend to be active and have a high sense of curiosity about the lessons given by the teacher. So that the tasks given by the teacher can be done properly. The emotional intelligence a person's ability to manage his emotional life with intelligence (to manage our emotional life with intelligence); maintaining emotional alignment and expressing it (the appropriateness of emotion and its expression) through self-awareness, self-motivation, empathy, and social skills. If individuals have high emotional intelligence, it will give birth to

high social sensitivity, and have the ability to adapt in all forms of conditions. Whereas in the conventional multiple-choice test form students who have high emotional intelligence are hampered by their creativity in answering the test, because in the use of conventional multiple-choice tests students tend to be passive.

The research hypothesis stated that in the group of students who had low emotional intelligence, the science learning outcomes of students who were given multiple-choice tests of association were lower than students who were given conventional multiple-choice tests. Based on the results of the study, in the group of students who had low emotional intelligence, the science learning outcomes scores of students who were given multiple-choice association tests were lower than the scores of students who were given conventional multiple-choice tests. This shows that for students who have low emotional intelligence, the use of conventional multiple-choice tests is more suitable than the use of conventional multiple-choice tests in learning. This is because students who have low emotional intelligence do not have high learning activities, such as lack of awareness in learning, lack of confidence, lack of self-motivation, and lack of positioning themselves as good students in class. Students who have low emotional intelligence tend to be passive in learning. These students usually only rely on the knowledge obtained from the teacher and do not value study time, so that in the multiple-choice test the results of the association of students who have low emotional intelligence are not able to follow the lesson well.

Conclusion

The results of the study revealed: (1) The science learning outcomes of students who were given multiple-choice tests of association were higher than those who were given conventional multiple-choice tests. (2) There is an interaction between the form of the test and emotional intelligence on students' science learning outcomes. (3) For students who have high emotional intelligence, the science learning outcomes of students who are given the multiple-choice test form of association are higher than those who are given the conventional multiple choice test form. (4) For students who have low emotional intelligence, the science learning outcomes of students who are given a conventional multiple-choice test are higher than those who are given an association multiple-choice test.

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