

# Scientific Competence of Madrasah Teacher Candidates Integrated with Scientific Literacy Based on Islamic Values through STEM Approach

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## ABSTRACT

This study aims to determine the results of competency tests and scientific literacy integrated with Islamic values and the influence of the STEM approach used in learning. This research was conducted in February-May 2023. This research is a quantitative research. The instruments used in this study were observation and test sheets. The results of the research that has been conducted on the STEM approach have a significant effect on scientific competence and also scientific literacy in prospective madrasah teachers, which in the provisions of the Independent Sample T-test test on Equal Variances Assumed if Sig. (2-tailed) <0.05 then the hypothesis is accepted, in this study it can be seen in the independent sample t-test test both seen from scientific competence and scientific literacy obtained the value of Equal Variances Assumed at the Sig level. (2-tailed) <0.05, which means that the hypothesis is accepted which states that there is an influence. Furthermore, the results of the scientific competency test during the pre-test for the control class had an average score of 67.52% and for the post-test score of 70.85%, while during the experimental class the pre-test score was 66.63% and the post-test score was 79.00%. For the scientific literacy test results at the time of the control class pre-test, the average score was 57.63% and for the post-test score was 74.90%, while in the experimental class the pre-test score was 61.70% and the post-test score was 77.30%. From these data, it shows that there is a significant difference in the average score between the acquisition of pre-test scores and post-test scores for both competence and scientific literacy during the experimental class trial. Where the average score of prospective teachers increased after using the STEM Approach (post-test) so that this approach has an effect on the scientific competence and literacy of prospective madrasah teachers.

Keywords: Scientific Competence, Scientific Literacy, STEM

## INTRODUCTION

Education has a very important role as a center of excellence in preparing the human personality, with education a person gains a lot of insight into knowledge, skills and attitudes so that it aims to improve the welfare of his life and can benefit religion, nation and nation (Rokhman, et al., 2014).

Education has an important influence to grow a human being with quality and potential. Education is a form of collaboration between students and teachers in exploring their abilities and potential during the learning process in the classroom (Panggabean, et al., 2021).

Education can be interpreted as a learning effort applied by educators to students in providing teaching, moral improvement and intellectual training (Sholichah, 2018; Amin and Hadiwinarto, 2022). Meanwhile, according to Palupi Putri (2018), education is the process of changing behavior by incorporating new knowledge into

existing beliefs and attitudes. Education is an important component of human existence that should not be ignored (N, 2015).

The purpose of national education is to help students realize their potential as human beings who believe and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become citizens. The quality of the findings of the achievement of educational goals will be determined by how the educational process is implemented. The quality of the education process is indicated in two ways: the quality of its components and the quality of its administration (Ilham, 2019).

In improving the quality and quantity that exists in each individual can be done by doing education. This shows that the level of interest in human resource development is high, especially in the era of globalization as it is today. The problems that will come can certainly be solved by the existence of human resources or the potential that

exists in humans, especially in the younger generation.

A learning that exists in the scope of education, for example madrasah schools, prospective educators must have qualified scientific competence in order to carry out the teaching and learning process effectively and efficiently so that it is easy to understand and fun for students. In learning, both methods and learning findings must be balanced (Junaedi, 2019). In other words, the scientific competence of prospective madrasah teachers will have a significant impact on the quality of their learning (Anggraeni & Akbar, 2018).

Prospective teachers who will act as facilitators later, must ensure that learners have an enjoyable journey through the learning process based on their knowledge and experience. Of course, to ensure that it can all go well, prospective teachers must have good scientific competence so that it has an impact on the learning process of students (Fakhrurrazl, 2018). If prospective teachers do not master scientific competence, it will affect pedagogical competence so that it can have an impact on a teacher's inability to convey science concepts optimally and students cannot understand the material presented (Suharni, 2021).

The importance of competence for prospective madrasah teachers is very clear, this is so that prospective madrasah teachers have the ability to have the right understanding so that students can understand and know the meaning of education itself and the commitment within themselves to always have a good impact on themselves and the surrounding environment (Rohendi, 2016). There are several scientific competencies that must be possessed, namely (1). Problem solving skills, (2). Science content, (3). Science literacy and (4). Mastery of science process skills.

Unfortunately, the level of science literacy of students in Indonesia is still relatively low. This can be seen from the ranking of science literacy of Indonesian students based on PISA 383, 382, 403, respectively, for 2009, 2012 and 2015. The low science literacy score indicates that Indonesian students' knowledge of science learning is still not extensive.

Science learning cannot be separated from religious learning. According to physicists, Charles A. Coulson and Harold K. Schilling "the methods of science and religion have much in common" (Barbour, 1968: p. 29). So that integration can be done in the subject. The same thing was also expressed by Ian G. Barbour who is known as the father of integration in the world. He is a physicist-

agapist scientist, who came up with 4 (four) models of the relationship between science and religion, namely: Conflict, Independence, Dialogue and Integration (Barbour, 2002: p. 44).

Learning activities that integrate Islamic values into science learning are useful so that students understand that science comes from the Qur'an. In addition, it guards students' beliefs and intellectuals towards the development of modern times. This is certainly supported by Ataji, et al., (2021) who stated that integrating Islamic values into science is the right choice of learning resources for students today, because it can foster faith and devotion for students. The Islamic values in question are incorporating or linking the verses of the Qur'an into the learning material. The values taught by the Qur'an will certainly make a quality individual so that later the world of education will produce a generation that has high spirituality.

Empirical facts from the results of observations that have been made at several PTKI in Bengkulu Province are known that in the Madrasah Ibtidaiyah Teacher Education study program for science learning still uses the KKN curriculum. As for the learning process, it has used teaching materials that are integrated with Islamic values, besides that it is also known that the average student score for science courses is 75% B. The use of teaching materials that integrate science with Islamic values has been used since 2020 after research was conducted by one of the lecturers of UIN Famawati Sukarno Bengkulu with the title of developing learning modules in integrated science courses integrated with Islamic values. These results were obtained from direct interviews with the study program coordinator and one of the Integrated Science lecturers for the PGMI study program in Bengkulu Province.

From the observations above, it shows that the learning process has taken place well where it has used teaching materials in the form of learning modules resulting from research products. It is necessary to conduct a follow-up study to measure scientific competence based on Islamic values-based scientific literacy skills possessed by prospective madrasah teachers at PTKI in Bengkulu Province. This needs to be done to determine the scientific competence of prospective teachers before they actually become prospective educators in the future. In addition, to prepare prospective madrasah teachers to be able to compete based on the demands of the times as it is today.

Current students in general, based on field findings, lack scientific literacy skills, especially in science lessons. That is why the figure of prospective madrasah teachers really must have

scientific competence, especially good scientific literacy because later they will become an educator who plays an important role in understanding the material being taught. (Zuraini, 2016) Adding that the success of a learning process depends on the role of the teacher as an educator, facilitator, administrator, and motivator for students in learning (Feni Farida Payon, 2021). Learning activities carried out by teachers are one of the determinants of the success of the student learning process (Insani, 2021).

Student interest in learning will arise if the teacher has good scientific literacy skills. Interest in learning is a curiosity that arises in a person about something, then wants to try to do it (Yunitasari and Hanifah, 2020). The impact of the desire to learn owned by students will certainly make it easier for teachers to deliver material (Mainam, 2018). In reality, in the field of science, students' interest in learning is not the same, because many students are more interested in liking other subjects that are not abstract, this is due to the tendency of teachers not to have good scientific literacy skills so that it is difficult to convey material, especially in the field of science itself because it is related to the fields of Physics, Chemistry and Biology. Therefore, to overcome and solve these problems, learning can be done using the STEM approach. According to (Twiningsih & Elisanti, 2021); (Ibtida et al., 2020) STEAM is an integrated and thematic learning that can be used by educators to study science as a science from various perspectives, namely using internet technology to improve science literacy. Because science is a series of knowledge materials that are arranged coherently or regularly and use special methods (Fatimah & Mufti, 2014).

STEM-based learning is able to generate scientific attitudes (Fasasi, 2017) and student activeness during learning (Subali, 2018). The application of STEM makes it easier for students to learn science by linking science to the environment around their homes. Several other studies have shown that STEM can improve students' scientific literacy (Alim, et al, 2019; Ariningtyas, et al, 2017; Maesaroh et al., 2021). According to (Prasetyo, 2017) Natural science is one of the sciences which means knowledge. Science is part of STEM. STEM is an acronym for science, technology, engineering, and mathematics. The STEM approach was first used by the NSF (National Science Foundation) in the 1990s. The STEM approach has several functions. These functions include training students to combine four different disciplines, science, technology, engineering, and mathematics, to solve problems related to

students' own experiences or real life (Rodriguez, et al., 2019).

Kang and Peters (2019) state that STEM literacy refers to: (1). The knowledge, attitudes, and skills of an individual to identify and explain a natural thing and draw conclusions based on the facts of STEM issues. (2). An individual's understanding based on STEM characteristics as a form of human knowledge, inquiry and design. (3). Response to how STEM shapes the material, knowledge and culture of the surrounding environment, and (4). One's desire to be engaged with STEM issues and ideas as a constructive, caring and reflective citizen (Zaki et al., 2020).

In science learning, of course, it is very identical to going directly to the field and understanding the natural environment scientifically (Rubiana and Dadi, 2020). Science is a study of science that studies the phenomena or events of nature (Aziar, 2016). In the field of science education has an important role in learning because the sciences that are studied are directly related to how to find out about nature systematically. In learning science is not only a collection of knowledge of facts and concepts, but also a discovery process based on scientific characteristics related to human life (Suharyati, 2022). So with the role of teachers in applying STEM to science learning, it is hoped that it can motivate students to understand the state of themselves and the life of the natural environment around them, so that they can provide lessons and knowledge that can be applied in society (Vennix et al., 2018).

Science lessons are essentially products, processes, attitudes, and technology. Therefore, science learning should be carried out in a scientific inquiry. In order to learn science in a scientific inquiry, science learning must be carried out by professional teachers who have good scientific literacy skills (Lia Portanata, 2017). Science as one of the subjects at school, can provide a role and experience for students. Science learning is expected to be an appreciation of nature which is the most important component for scientific literacy (Donohue, et al, 2020). However, prospective teachers and even educators often feel confused about the scope of what should be known in implementing science based on Islamic values in learning. So, knowledge about the research that will be conducted by researchers is needed in order to implement scientific competence integrated with Islamic values-based scientific literacy. This study aims to measure the extent of competence possessed by prospective madrasah teachers through the STEM approach in the PGMI study program. The problem

formulations are: 1) To what extent is the level of scientific competence of prospective madrasah teachers integrated with Islamic values-based scientific literacy through the STEM approach in Bengkulu Province? 2) How are the results of the scientific competency test of prospective madrasah teachers integrated with scientific literacy based on Islamic values through the STEM approach in Bengkulu Province? 3) Is there an effect of STEM approach on scientific competence of madrasah teacher candidates integrated with Islamic values-based scientific literacy in Bengkulu Province?

## THEORETICAL STUDIES

The nature of science itself is defined as the epistemology of science, science as a way of finding out, or the values and beliefs inherent in scientific knowledge and its development. However, various studies show that students of various levels, ranging from kindergarten to university level, generally do not have a good understanding of the nature of science (Lederman, 1992).

Furthermore, according to Nurcholish, the rivalry between religion and social science is more about the difference in attitude in explaining the situation or reality. At least, social science has two things in explaining reality that make it different from what religion believes, namely: first, social science really wants to explain reality; and second, many social sciences pay attention to the formation of a paradigm, but the scientific tools used have not been able to answer empirical problems that are still a question. This rivalry between religion and science has two forms; the first form, social science claims that it is compared to religion; and the second form, social science makes itself a separate option (choice) to build a *weltanschauung*.

In addition, STEAM aims to stimulate and motivate students about higher-order thinking that includes problem solving, collaborative strategies, independent learning, project-based learning, challenge-based learning, and research. (Twiningsih & Elisanti, 2021). STEM can produce quality human resources who are ready to face the challenges of the global era like today because STEM is able to answer the needs of those who have abilities in the fields of science, technology, engineering and mathematics.

## RESEARCH METHODOLOGY

This research is quantitative research. This research uses the Quasi Experimental Design research method. This form of experimental design is a development of true experimental design, which is difficult to implement. This design has a

control group, but cannot function fully to control outside variables that affect the implementation of the experiment. However, this design is better than pre-experimental design. Quasi-experimental design, used because in reality it is difficult to get a control group used for research.

This study was conducted by measuring the results of scientific competency tests with a science literacy approach based on Islamic values in the PGMI study program at PTKI in Bengkulu Province which includes 4 districts namely Rejang Lebong, Bengkulu City, South Bengkulu and Kaur. This research was conducted to explore the scientific competence of prospective madrasah teachers using the STEM approach.

The samples in this study were 4th semester and 6th semester students. Both for the experimental and control classes, which were obtained using Purposive Sampling technique. Purposive Sampling is a data source sampling technique with certain considerations. The reason why sampling is done by Purposive Sampling is because the students who are sampled have done internship practice at school.

The instruments used in this study were observation sheets and tests. The test questions in this study were in the form of multiple choice questions as many as 50 questions. The data analysis used descriptive quantitative analysis with statistics assisted by the spss 22 application.

Table 3.1 Research design

Group	Pretest	Treatment	Posttest
Experiment	X <sup>1</sup>	O	X <sup>2</sup>
Control	Y <sup>1</sup>	-	Y <sup>2</sup>

## RESULTS

### A. Description of Research Location

#### 1. UIN Fatmawati Sukarno Bengkulu

UIN FAS Bengkulu is one of the state Islamic universities in Bengkulu City. UIN FAS Bengkulu is a transformation or institutional change from Institut Agama Islam Negeri Bengkulu (IAIN Bengkulu) and is now Accredited A.

Previously, the university was a branch of IAIN Raden Patah Palembang and later developed into the Bengkulu College of Islamic Studies (STAIN). Over time, its status changed again to Bengkulu State Islamic Institute (IAIN) based on Presidential Regulation No. 51 of 2012. And now it is Fatmawati Soekarno State Islamic University or UIN FAS Bengkulu.

This is the result of the journey of the hard work of the entire academic community together with all parties in Bengkulu Province until finally IAIN Bengkulu can transform or

change its status to UIN Fatmawati Sukarno (UIN FAS) Bengkulu based on RI Perpres No. 45 of 2021 on May 11, 2021. The address is located at Jalan Raden Fatah, Pagar Dewa Village, Selebar District, Bengkulu City, Tel: (0736) 51171 while @Mail: admin@uinfasbengkulu.ac.id.

UIN FAS Bengkulu currently has 4 faculties with 24 study programs for S1 plus 6 study programs for S2 (Master) programs and 2 study programs for S3 (Doctoral) programs. The faculties in S1 include Sharia and Law, Economics and Islamic Business, Tarbiyah and Tadris, Ushuluddin Adab and Da'wah. And the Master Program which consists of 6 study programs, namely: Islamic Law, PAI, MPI, AFI, HTN and PIAUD. Meanwhile, the Doctoral Program consists of Islamic Education and Islamic Studies.

## 2. STIT AL Qur'aniyah Manna

The current existence of STIT Al-Quraniyah Manna cannot be separated from the basic idea of its establishment, which is to produce academic and professional staff who are faithful, devoted and highly dedicated to the interests of the nation. The basic idea is outlined in the Statute of STIT Al-Quraniyah Manna, especially Article 3 on the Principles, Functions, and Objectives of STIT Al-Quraniyah Manna.

STIT Al-Quraniyah Manna can become what it is today, none other than thanks to an educational institution that is managed and financed by a foundation established on February 22, 1993 under the name Affan Foundation, with Notary Deed No. 6. At this time (Academic Year 2022/2023) College with the name STIT Al-Quraniyah Manna which is located at Jl. Affan Bachsin No. 13 Manna South Bengkulu for the time being chaired by Dr. Rizki Ramadhani, M.Pd.I with No. Telp./Fax. (0739) 21689 and zip code (38518).

## 3. STIT AL Wasi Kaur

College of Tarbiyah STIT Al Wasi Kaur officially operates as well as being the first campus in Kaur Regency Activities are centered on the Al Wasi Kaur Campus in Penyandingan Village, Central Kaur District The Decree on the operation of the STIT Al Wasi College of Tarbiyah from the Ministry of Religion of the Republic of Indonesia was submitted by the Head of the Sub-Directorate of Institutional and Cooperation of Islamic Religious Higher Education of the Ministry of Religion of the Republic of Indonesia Dr Thobib Al Asyhar to the Chairperson of the Al Wasi Kaur Foundation Dr Juliansyah M Pd I There are two

Study Programs in the Faculty of Tarbiyah Science in Kaur Regency The establishment of this high school is not as easy as turning the palm of the hand It takes a process time of approximately four years before it is finally officially established and gets the decree of the Ministry of Religion of the Republic of Indonesia Improving human resources with morality is a noble vision and mission that it carries in the establishment of the high school STIT Al Wasi Kaur not only belongs to our foundation or its students.

## 4. IAIN Curup

The birth of IAIN Curup has a long historical background. In the beginning, it was just a Faculty of Ushuluddin that had the status of a distant faculty of IAIN Raden Fatah Palembang. In other words, the forerunner of IAIN Curup at that time was the Faculty of Ushuluddin IAIN Raden Fatah Palembang located in Curup.

The idea of establishing the Faculty of Ushuluddin began with the formation of the Preparatory Committee for the Establishment of the Faculty of Ushuluddin IAIN Raden Fatah Curup Branch on October 21, 1962. The composition of the committee consisted of Patron, Advisor, Chairman I, Chairman II, Secretary I, Secretary II, Treasurer, Assistant and Sections. The founders of this Faculty, among others, had the support of Prof. DR. Mr. Hazairin, HM. Husein, Governor of South Sumatra, Prof. Ibrahim Husein and others.

Shortly after the Preparatory Committee for the Establishment of the Faculty of Ushuluddin Raden Fatah Curup Branch was formed, the Taqwa Foundation Palembang Curup Branch was also established. The idea of establishing the Faculty of Ushuluddin received a warm welcome and enthusiasm from all levels of Curup society. With a lot of support from various parties, in 1963 the Taqwa Foundation Palembang Curup Branch established the Faculty of Shari'ah with private status. The Faculty of Shari'ah was led by Drs. A. Zaidan Djauhari as Dean and Drs. Djam'an Nur as Vice Dean.

Almost simultaneously with the change in status of IAIN Raden Fatah Palembang, which was originally a branch of IAIN Sunan Kalijaga Yogyakarta to become an independent IAIN, the Faculty of Shari'ah IAIN Raden Fatah Curup was also changed to the Faculty of Ushuluddin. With the issuance of the Decree of the Minister of Religious Affairs of the Republic of Indonesia No. 86 of 1964, in 1964 the Faculty of Ushuluddin, which was originally private, became public. The leadership elements at that time were KH. Amin Addary as Dean, Drs. Djam'an Nur as Vice Deans I and III, M. Yusuf Rachim, SH. As Vice Dean II and IV. The Decree of Change of status from private to public above was followed by the issuance of



Decree of the Minister of Religious Affairs Number: 87 Year 1964 which states that the Faculty of Ushuluddin Raden Fatah Curup is an integral part of IAIN (Al-Jami'ah Islamiyyah Al-Hukumiyyah) Raden Fatah domiciled in Palembang, the capital city of South Sumatra Province.

## B. Description of Research Results

### a. Scientific competence of madrasah teacher candidates

The results of the scientific competence of prospective madrasah teachers in this study were obtained from the implementation of the Pretest and Posttest given to the experimental and control classes. Both classes were sampled from the four PTKIs in Bengkulu Province. The data were used to determine the results of the scientific competency test of madrasah teacher candidates between the experimental and control classes. In addition, to know the effect of STEM approach on the scientific competence of prospective madrasah teachers from the four PTKIs in Bengkulu Province.

### a) Descriptive Analysis

Used to describe or describe research data, which includes the amount of data, maximum value, minimum value, average value and so on. From the results that have been carried out, it is known that the experimental class pretest results have an average value of 66.63. Where the highest score is 87 and the lowest score is 40. For the post-test results the experimental class has an average score of 79.00. Where the highest score is 98 and the lowest score is 50. Meanwhile, the control class pretest results have an average value of 67.52. Where the highest score was 87 and the lowest score was 45. For the post-test results, the control class had an average value of 70.85 with the highest score of 89 and the lowest score of 49. Before conducting hypothesis testing, a prerequisite test was carried out, namely the normality test to see whether the pretest and post-test results of prospective madrasah teachers were normally distributed or not and the homogeneity test to see whether the scientific competence of prospective madrasah teachers was homogeneous or not.

### b) Normality Test

Used to determine whether the research data is normally distributed or not. It is known that the significance value (sig.) for all data in the shapiro-wilk test > 0.05. So it can be concluded that the research data is normally distributed. Because the data is normally distributed, a parametric

statistical test (independent sample t test) is carried out.

### c) Homogeneity Test

Used to determine whether the data of a variance (diversity) of research results are homogen (the same) or not. It is known that the homogeneity test of the experimental class and control class shows homogeneous distributed data because the significance value is > 0.05.

### d) Independent Samples T Test

The data from the pre-test and post-test are normally distributed, therefore further testing can be carried out using parametric tests using the t-test on SPSS 21. The Independent t-test test is used to see whether there is a difference in the post-test results of students from the experimental class and control class With the decision: if the significance value (sig-tailed) < 0.05 then  $H_0$  is rejected and  $H_a$  is accepted and if the significance (sig-tailed) > 0.05 then  $H_a$  is rejected and  $H_0$  is accepted.

Independent Samples Test					
	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	Df	Sig. (2-tailed)
Scientific	2.473	.120	3.179	78	.002
Competence			3.179	73.750	.002

From table 4.1, it is known that the t test results obtained a significance value of 0.002 is smaller than 0.05 (sig: 0.002 < 0.05). So it can be said that  $H_0$  is rejected and  $H_a$  is accepted, meaning that there is a significant difference between the post-test of the experimental class and the control class. Which is known that the post-test of the experimental class was carried out after the learning ended using the STEM approach while the control class was learning as usual. So it can be concluded that there is a significant effect of the STEM approach on the integrated competence of scientific literacy in the experimental class.

### b. Scientific literacy of madrasah teacher candidates

The results of scientific literacy of prospective madrasah teachers in this study were obtained through questionnaires given to experimental and control classes. The data was used to determine the scientific literacy test results of madrasah teacher

candidates between the experimental and control classes. In addition, to find out the effect of the STEM approach on the scientific literacy of prospective madrasah teachers from the four PTKIs in Bengkulu Province.

#### 1. Descriptive Analysis of Scientific Literacy

This data analysis helps to check whether the data is in accordance with the actual data, then processed and analyzed to provide an overview of the research data, which includes the amount of data, maximum value, minimum value, average value and others. The results of descriptive statistics are as follows:

##### 1) Control Class

Based on the descriptive table of variables above, it can be seen that the results of the Pre-Test and Post-Test of the control class of 40 students, have a minimum Pre-Test score of 33, a maximum Pre-Test score of 82, and a minimum Post-Test score of 63, a maximum Post-Test score of 92. By having a mean Pre-Test of 57.63 and a mean Post-Test of 74.90. Sarat has a standard deviation for Pre-Test 12.573 and for Post-Test 7.629.

##### 2) Experiment Class

Based on the descriptive table of variables above, it can be seen that the results of the Pre-Test and Post-Test of the experimental class of 25 students, have a minimum Pre-Test value of 36, a maximum Pre-Test of 83, and a minimum Post-Test of 50, a maximum Post-Test value of 95. By having a mean Pre-Test of 61.70 and a mean Post-Test of 77.30. Sarat has a standard deviation for Pre-Test 11.314 and for Post-Test 9.233.

#### 2. Normality Test

The purpose of the normality test is to determine whether the pre-test and post-test data collected are generally present or not. In this study, the Shapiro-Wilk test was conducted using IBM SPSS 21. The general test results can be seen in the table below:

Based on the results of statistical tests that have been carried out from the control class, the Pre-Test results are 0.690 and Post-Test 0.116 while the experimental class obtained a Pre-Test of 0.771 and Post-Test of 0.486. Therefore it can be concluded that the control and experimental classes are normally distributed because  $0.05$ .

#### 3. Homogeneity Test

The homogeneity test is used to show that two or more sets of sample data from the population have the same variance. The homogeneity test is applied to Pre-Test and Post-Test data from the control class and

experimental class. Data can be said to be the same if  $\text{sig} > 0.05$ , but if  $\text{sig} < 0.05$  means the data is not the same.

Based on the results of the statistical test assisted by SPSS 27, the results of the Homogeneity Test were obtained with a significance of 0.429 for the posttest results. From these results it can be concluded that the posttest result of  $0.429 > 0.05$ , is homogeneous, meaning that the data is homogeneous.

#### 4. T-Test (Hypothesis Test)

The T test in this study used the independent-samples T-test, because the sample used consisted of 2 classes. The significance for the independent-samples T-test is  $\text{sig} < 0.05$ , which means  $H_a$  is accepted. But, if the significance  $\text{sig} > 0.05$ , then  $H_0$  is rejected. The research hypothesis to be tested is:

$H_0$  = There is no effect of STEM approach on scientific literacy of madrasah teacher candidates.

$H_1$  = There is an effect of the STEM approach on the scientific literacy of prospective madrasah teachers. The following is the Independent-Samples T-test using IBM SPSS 21 for windows in the following table.

Table 4.2 T-Test (Hypothesis Test)

Source: IBM SPSS Statistics 21

Based on the statistical test results, the significance is obtained,  $\text{sig}$  (2-tailed) 0.00. Then the significance of 0.00 is stated to be smaller than 0.05 ( $0.00 < 0.05$ ). So it can be found that the difference in the level of confidence is 5%. This means that  $H_0$  is rejected and  $H_a$  is accepted.

#### C. Discussion of Research Results

The purpose of this study was to determine the results of the scientific competency test integrated with scientific literacy of prospective madrasah teachers and to see the effect of the STEM approach on the scientific competence of prospective madrasah teachers integrated with Islamic values-based scientific literacy in Bengkulu Province. In this study, prospective teachers were sampled from four universities, where each university was taken as many as 20 people. Furthermore, the sample was divided into two classes, namely the experimental class and the control class. To see the scientific competence of prospective madrasah teachers, pre and post tests were given in the form of multiple choice questions while scientific literacy was given a questionnaire sheet. Giving this pretest aims to determine whether the initial ability of the two classes is different or not on scientific competence. While the post-test aims to see if there is an effect of the STEM approach that has been given after the end

of learning on scientific competence. From the results of the independent sample t-test test, the Sig. (2-tailed) = 0.02 for scientific competence and 0.00 for scientific literacy, from both test results show that the Sig. (2-tailed) > 0.05.

From the results of data analysis, it can be seen that the scientific competence and scientific literacy of prospective madrasah teachers in the experimental class using the STEM approach is higher than the class using a conventional learning approach, meaning that the STEM approach is

Independent Samples Test						
		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	T	Df	Sig. (2-tailed)
Scientific Literacy	Equal variances assumed	.632	.429	-1.267	78	.000
Outcomes	Equal variances not assumed			-1.267	75.322	.000

better for improving scientific competence and scientific literacy of prospective madrasah teachers.

This success is due to the fact that the STEM approach meets the criteria of 21st century learning including the following; 1) learner-centered learning approach; 2) learners are taught to work together; and 3) learning materials are related to daily life problems. Based on these problems and situations, the concept of 21st Century education was created and promoted by relevant experts, institutions and educational agencies in Indonesia and around the world. (Davidi, Sennen & Supardi. 2021). The Science, Technology, Engineering, and Mathematics (STEM) approach is one of the educational approaches that can meet the characteristics of 21st century learning (Lestari, Astuti & Darsono. 2018). STEM integrates the fields of science, technology, engineering, and mathematics with a focus on solving real-life problems.

The STEM approach teaches how real-world concepts, principles and technologies are used to solve problems, thus improving scientific competence and literacy. STEM learning combines various disciplines into a cohesive learning paradigm based on the real world. STEM literacy refers to acquiring science, technology,

engineering and math knowledge and using it to identify problems and discover new knowledge. Understand the characteristics of STEM as a form of human endeavor, including design, inquiry, and analysis processes (Elia et al, 2021).

In addition, STEM is an interdisciplinary approach and helps prospective teachers in learning. This approach involves the application of science, technology, engineering, and mathematics in an interschool context to improve the competence and scientific literacy of prospective madrasah teachers (Maulidia, Lesmono & Supriadi. 2019). Furthermore, it can create new learning practices and use STEM education in solving a problem, and can help prospective teachers collect, analyze, and solve problems, and understand how one problem relates to another (Oktaviyani, Kusumah & Hasanah, 2020). STEM abilities also train skills to solve a problem and support from scientific behavior, making STEM integration always strive to create innovation, STEM approaches are important in the world of education (Mu'minah & Aripin, 2019). In general, the objectives and benefits of the STEM learning approach are expected to hone critical, creative, logical, innovative and productive thinking skills, instill a spirit of mutual cooperation in solving problems.

STEAM is a learning approach that emphasizes knowledge relationships, meaning that they are related to one another. The use of technology to create and communicate innovative solutions as a medium to develop the ability to find and solve a problem (Utomo, Rahman & Fikrati. 2019).

So, the importance of the Science Technology Engineering Mathematics (STEM) approach to improve scientific competence and scientific literacy for prospective madrasah teachers is a must so that it can play an active role for the continuity of a better learning process, and can help students also understand more during the teaching and learning process and can also solve problems faced in the learning process.

Developing scientific competence can help prospective teachers design effective learning experiences. By having strong scientific competencies, prospective teachers can create engaging and meaningful science education experiences for their students, preparing them for the challenges of the modern world. The importance of scientific competence for prospective teachers can be explained as follows:

Scientific competence helps prospective teachers understand and address unique individual differences among students. These include physical attributes, intelligence levels, personality, psychological traits, language proficiency, and learning styles. By having strong scientific competence, teachers can adjust their teaching methods to accommodate the needs of diverse students (Sari & Mudjiran 2020).



Scientific competence is an important aspect of professional competence for prospective teachers. It enables them to effectively manage and facilitate science learning activities, guide students in their scientific investigations, and fulfill their roles as educators. By continuously improving their scientific competence, prospective teachers can provide quality science education to their students (Febriana, et al., 2020).

Scientific competence enables prospective teachers to integrate Islamic values into their science teaching. This integration helps students understand the compatibility between Islam and scientific inquiry, promoting a deeper understanding of the Islamic worldview. By incorporating Islamic values into science education, prospective teachers can promote ethical decision-making, moral reasoning, and a holistic understanding of the world (Ratu, et al., 2022).

Scientific competence enables prospective teachers to develop and improve Higher Order Thinking Skills (HOTS) among students. HOTS are essential for fostering creativity, innovation and critical thinking. By incorporating HOTS into science education, prospective teachers can equip students with the skills needed to analyze, evaluate and apply scientific knowledge in a real-world context (Sopian, et al., 2022).

Scientific competence equips prospective teachers with the skills to utilize technology effectively in the science classroom. In the digital age, technology plays an important role in education. By having strong scientific competence, prospective teachers can incorporate technological tools and resources into their teaching, making science education more interesting and interactive for students (Wulandari, et al., 2021).

From the above statements, we can conclude that scientific competence is very important for prospective teachers as it enables them to understand individual differences, develop Higher Order Thinking Skills, integrate Islamic values, use technology effectively, and improve their professional competence in science education. By having strong scientific competence, prospective teachers can create interesting and meaningful learning experiences for their students, preparing them for the challenges of the modern world.

Scientific competence is essential for prospective teachers as it has a significant bearing on the quality of teaching and mentoring they provide to students. Scientific competence allows prospective teachers to teach with a strong foundation in their preferred field of study. With a deep understanding of scientific concepts, research methods, and the latest developments in the field, they can provide students with a better understanding and explain material in a clearer and more detailed manner.

Scientific competence allows prospective teachers to develop critical thinking skills in

students. They can prohibit students from breaking down information, analyzing scientific evidence, and identifying valid arguments. This helps students develop critical thinking abilities that are important in problem solving and decision making. Scientific competence allows prospective teachers to prohibit students about the scientific method. They can help students understand the steps in conducting research, designing experiments, collecting and analyzing data, and interpreting results. This helps students understand the scientific process and develop research skills that are important in a variety of fields. In addition, scientific competence allows prospective teachers to integrate science concepts in students' daily lives. They can show how science plays a role in various aspects of life, such as health, environment, technology and others. This helps students understand the relevance of science in their lives and develop a greater appreciation for science.

Scientific competence enables prospective teachers to help students become citizens who deliver scientific communication. They can instruct students to preserve scientific evidence, protect the research process, and make decisions based on accurate and reliable information. This helps students develop a healthy skepticism and avoid unfounded thinking. By having strong scientific competence, prospective teachers can provide more effective teaching, encourage critical thinking, and help students develop a deep understanding of science. Improving scientific needs can be done through further education, training, participation in research, and practical experience in applying the scientific method. In addition to competence, prospective madrasah teachers must also have good scientific literacy. Scientific literacy refers to a person's ability to understand, evaluate, and use scientific information effectively. It involves the ability to read, hide, and criticize scientific articles, journals, books, and other sources related to research and science.

Scientific literacy is essential in an increasingly complex and globally connected world. By having good scientific literacy, one can make better decisions based on scientific evidence, understand and appreciate the scientific method, and participate in scientific discussions and debates.

To improve scientific literacy, there are several steps that can be taken, such as reading scientific articles regularly, taking courses or training in the scientific method, participating in scientific discussions, and asking critical questions about scientific information encountered.

As an aspiring teacher, scientific literacy is very important as it will help you in teaching and guiding your students. Here are some reasons why scientific literacy is important for prospective teachers: 1. Scientific literacy will help you understand science concepts better, so you can

teach more effectively. You will be able to prohibit your students about the scientific method, help them understand how research is conducted, and prohibit them from thinking critically about scientific information. 2. Scientific literacy will help you develop critical thinking skills that are very important in teaching. You will be able to prohibit you to hide the information they receive, identify bias, and ask relevant questions. 3. By having good scientific literacy, you will be able to help your students understand the importance of science in everyday life. You will be able to show them how science affects their lives, and prohibit them from making decisions based on scientific evidence. 4: By having good scientific literacy, you will be able to develop better teaching strategies. You will be able to prohibit your students in a more effective way, and help them understand science concepts better and 5. Improve your credibility as a teacher: By having good scientific literacy, you will become more credible as a teacher. You will be able to provide accurate and up-to-date information to your students, and help them understand science better.

In order to improve scientific literacy, prospective teachers can take steps such as reading scientific articles regularly, taking courses or training in scientific methods, participating in scientific discussions, and asking critical questions about scientific information encountered.

Integrating Islamic values into science and technology can lead to the creation of a comprehensive and complete body of knowledge rich in religious values. This approach recognizes that Islam is a complete and total system that covers all aspects of human life, including scientific research and technological advancement (Ikmal, 2018). The integration of Islamic values and science is important for several reasons: 1. Integrating Islamic values with science allows for a more holistic approach to education. It recognizes the importance of both religious and scientific knowledge in shaping an individual's understanding of the world. This integration helps students develop a balanced perspective that combines faith and reason (Isgandi, 2021). 2. Science provides knowledge and tools for understanding the natural world, but it does not inherently provide an ethical framework. By integrating Islamic values, science education can incorporate moral and ethical considerations into scientific discussions. This helps students understand the ethical implications of scientific advances and encourages responsible and ethical scientific practice.

Integrating Islamic values with science helps students see the compatibility between Islam and scientific inquiry. It enables them to view science as a means to explore and appreciate the wonders of Allah's creation. This integration helps students develop a deeper understanding of the Islamic worldview and strengthens their faith.

Islamic values emphasize the importance of seeking knowledge and understanding the world

around us. By integrating Islamic values with science, students are encouraged to engage in critical thinking, questioning and inquiry. This integration fosters a curiosity-driven approach to learning and encourages students to explore scientific concepts within an Islamic framework.

The integration of Islamic values and science can help address contemporary issues and challenges faced by Muslim communities. It enables the exploration of scientific advances and their implications from an Islamic perspective. This integration allows students to navigate complex ethical dilemmas and make informed decisions that are aligned with their beliefs.

Overall, the integration of Islamic values and science provides a comprehensive and well-rounded education that combines religious teachings with scientific knowledge. It helps students develop a deep understanding of both disciplines and encourages them to apply Islamic values in their scientific pursuits. This integration promotes critical thinking, ethical decision-making, and a holistic understanding of the world.

## CONCLUSIONS

Based on the results of the research that has been carried out, it can be concluded that there is a difference in the average value of the pre-test and post-test results conducted in the experimental class, from these results it shows an increase in both competence and scientific literacy of prospective madrasah teachers. The STEAM approach has a significant effect on scientific competence and also scientific literacy in prospective madrasah teachers, which in the provisions of the Independent Sample T-test test on Equal Variances Assumed if Sig. (2-tailed)  $<0.05$  then the hypothesis is accepted, in this study it can be seen in the independent sample t-test test both seen from scientific competence and scientific literacy obtained the Equal Variances Assumed value at the Sig level. (2-tailed)  $<0.05$ , which means that the hypothesis is accepted, which states that there is an effect of the STEAM approach on the scientific competence and scientific literacy of prospective madrasah teachers.

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