

Integration of Islamic Education And Science In Realizing A Superior Generation For Indonesia Gold 2045 in Pesantren Tebuiireng

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Abstract

Pesantren is known as a traditional educational institution with the yellow book. However, with all its traditionalism, pesantren have been in contact with the development of science. Thus, pesantren emerged that integrated their traditional Islamic education with science and technology, such as Pesantren Sains Tebuiireng Jombang and Pondok Putri Pesantren Tebuiireng Kesamben Jombang. Then, this can be linked to the role of pesantren in helping to realize the vision of Indonesia Gold

2045, welcoming 100 years of Indonesia. This research aims to document, describe, and understand how these two institutions integrate Islamic education and science to create an excellent generation toward the Golden Indonesia 2045. In addition, it is also to provide inspiration for other pesantren institutions, that the intersection of science with pesantren is not a taboo. The research approach is descriptive qualitative with an observational research method. Active and full participatory observation (total participant observation) was chosen with the aim of having the researcher as the main instrument or tool of the research, directly and fully involved in every process and activity related to the research subject.

Keywords: *Integration of Islamic Education and Science, Superior Generation, Golden Indonesia 2045, Science Pesantren of Tebuireng*

INTRODUCTION

Pesantren, as a place where Islamic teachings developed, played an important role as a center of Islamic civilization in the past. From the pesantren emerged Muslim scholars, independence fighters, various arts, reformist figures, and refined and commendable Islamic cultures. As a religious institution, pesantren initially only taught religious knowledge. However, with the passage of time, pesantren not only opened religious-based schools but also general schools that provide general knowledge (natural sciences, social sciences, and languages) to their students. Pesantren is identical to the education of the *kitab kuning*. With the presence of formal schools owned by pesantren today, Islamic religious education is no longer centered in the dormitory through *Bandongan*, *Sorogan*, and *musyawarah* studies, but is also integrated into *diniyah* programs in formal schools. On the other hand, pesantren are demanded to keep up with the times when science and technology are experiencing rapid advancements. Pesantren is touted as an Islamic educational institution that can restore the glory of past Islam contextualized in this era.

As an important part of human life, knowledge has developed rapidly since the 19th century. Since then, people have conducted many important experiments and discoveries. Previously, this science had undergone various relay revolutions in different countries such as Greece, Arabia, India, China, Europe, and America. Since the late 19th century until now (the 21st century), the torch of knowledge has been in the Western world, allowing them to dominate the advancement of science and technology today. However, this does not mean neglecting the potential of

Muslims, because we still have the holy book that is always sacred, the Al-Quran al-Karim, which also contains many scientific secrets.¹

In Damascus, Islam first prioritized knowledge in the 7th century AD. Early Muslim scholars such as Khawarizmi, al-Farabi, Ibn Firnas, Ibn Sina, and Ibn Rushd eventually moved to Baghdad as a result of the raging wars, where they created highly popular works. After that, the center of Islamic science moved west—specifically to Cairo—and eventually reached Spain after the year 970 AD. Many important works in Islamic science were translated into English, and the original books were burned. Since then, the progress of science in the Islamic world has stagnated.² On the other hand, the advancement of science in the West (Western countries) quickly surpassed that scientific culture. Great scientists began to emerge. For example, in the field of physics, the name Galileo emerged, who was later punished by the church because his views contradicted the church, Isaac Newton who introduced the theory of gravity and classical mechanics, and then Albert Einstein with his theory of Relativity which underpins quantum mechanics.³

After all, this model of science and religion in the world has affected Islam, maybe even to the point of Indonesia. This is possible since Islam as a whole as early as 13 M experienced decline, territorial disintegration, and Western colonialism toward Islam. As a result of Barat's positivistic science, the Islamic world is also affected, and the relationship between Islam's religion and knowledge can never be fully understood. This positivistic sains has caused a new problem for humanity as religion, which ought to be a part of daily life, has been criticized.⁴

The caretaker of Pesantren Tebuireng from 2006 to 2020, KH. Salahuddin Wahid sensed the signals indicating the need to restore the integration of Islam with Science that had occurred in the past, accommodating it within the school and

¹ Irawan Irawan, Jenal Aripin, dan Tedi Priatna, "Pengelolaan Sains Dan Teknologi Di Pesantren," *Jurnal Dirosah Islamiyah* 5, no. 2 (13 Februari 2023): 378-86, <https://doi.org/10.47467/jdi.v5i2.3293>.

² M. Syamsul Huda, Rubaidi Rubaidi, dan Imam Ibnu Hajar, *Feminisme dalam Peradaban Islam* (Pena Cendekia Wonocolo - Surabaya, 2019), <https://repository.uinsa.ac.id/id/eprint/1042/>.

³ Pasiska Pasiska, "Epistemologi Metode Pendidikan Islam Ibnu Khaldun," *El-Ghiroh : Jurnal Studi Keislaman* 17, no. 02 (12 Oktober 2019): 127-49, <https://doi.org/10.37092/el-ghiroh.v17i02.104>.

⁴ Mohamad Yusuf, "Epistemologi Sains Islam (Studi Pemikiran Agus Purwanto Dalam Buku Ayat-Ayat Semesta Dan Nalar Ayat-Ayat Semesta)," 1 Januari 2017, 291, https://www.academia.edu/112692949/Epistemologi_Sains_Islam_Studi_Pemikiran_Agus_Purwanto_Dalam_Buku_Ayat_Ayat_Semesta_Dan_Nalar_Ayat_Ayat_Semesta_.

pesantren curriculum that is identical to traditional Islamic education. Then the idea emerged to establish Pesantren Sains (Trensains) under the auspices of Pesantren Tebuireng in 2014, with the SMA Trensains unit, followed in 2018 by the SMP Sains located in Jombok Ngoro Jombang. In 2020, a science-based girls' pesantren also emerged in Kesamben Jombang, based on a madrasah, namely MTs Sains Salahuddin Wahid, and now, the latest this year, it has an MA Sains.

The concept of Pesantren Sains Tebuireng refers to the study of science based on scientific verses in the Quran, adapted to the national and pesantren curriculum. Students are invited to study the verses of the universe and compare them with the natural sciences that have developed. The hope is to produce an outstanding Islamic generation ready to become scholars in the future. This aligns with the projection of Indonesia Gold 2045, where Indonesia will have the opportunity of a demographic bonus, with the productive age group being dominant. In the document Vision of Golden Indonesia 2045, which was drafted in 2019, there are four main pillars to realize it, namely, 1) Human development and mastery of science and technology, 2) Sustainable economic development, 3) Equitable development, 4) Strengthening national resilience and governance.⁵

On the first point, namely Human Development and Mastery of Science and Technology, it is an embodiment of the mandate of the 1945 Constitution which is part of the eternal mission of the state, namely, to enlighten the nation's life. Therefore, of the 3 priority acceleration programs, one of them is the acceleration of vocational education and special skills, meaning education aimed not only at cognitive interests but also bringing changes to a progressive civilization based on digital technology in those schools.

RESULTS AND DISCUSSION

Background of the Integration of Islamic Education and Science in Tebuireng

The late KH. Salahuddin Wahid, before establishing the Science Pesantren in Tebuireng, observed that there are indeed many pesantren in Indonesia, but their main focus is on religious knowledge. None had the uniqueness of looking towards future developments, especially in science and technology. In fact, science or technology is meant to make human life easier. If the pesantren does not keep up with developments or does not have a role in it, because previously during the

⁵ "Aspirasi - RPJPN 2025-2045," diakses 7 Desember 2024, <https://indonesia2045.go.id/aspirasi>.

golden age of Islam, where many scientists were Muslims, we were a progressive and advancing religious community. For that reason, Pesantren Tebuiireng wants to bring back the era when al-Khawarizmi lived.⁶

The Indonesian population is predominantly Muslim. However, in the fields of science and technology, Indonesian Muslims have so far acted as consumers rather than producers or creators. Therefore, the philosophy of these pesantren students is that they can become scientists from among the majority Muslim population in Indonesia, which is why Pesantren Tebuiireng is considered necessary to establish a Trensains high school. Gus Sholah believes that Muslims are still overly focused on discussing *fiqh* or Islamic law. In fact, there are 800 verses in the Quran that discuss science or *kauniyah* verses. So, in 2012, Gus Sholah met with a physicist from ITS, Prof. Agus Purwanto, who happened to be his junior at ITB, to discuss how to establish a science-based pesantren and integrate it with Islamic education, particularly the Quran. Then, SMA Trensains Tebuiireng was established, located about 10 km from the central Pesantren Tebuiireng in Cukir, specifically in Jombok Village, Ngoro District, Jombang Regency.⁷

Then in 2018, Tebuiireng felt the need for the foundation of the integration of science and the Quran to start from a lower level, namely junior high school, so the Science Junior High School was established, which is located in the same complex as the Science Senior High School or previously known as Pesantren Tebuiireng 2, now renamed Pesantren Sains Tebuiireng. The fact that not all students entering SMA Sains have a good background in Islamic education, or their Arabic language skills are not guaranteed, led SMP Sains to prepare them with basic science, Arabic, and Quran skills, so that when they enter SMA Trensains, they can follow the next level well and minimize scientific basis obstacles.⁸

Next, wanting to develop the integration of science and Islamic education, Tebuiireng established the MTs Sains Salahuddin Wahid unit in 2019. The initiator, Gus Sholah, felt the need to expand the reach and accessibility for aspiring Muslim scientists so they could learn well. Previously, the concept was a school under the Ministry of Education, with MTs Sains as a madrasa generally under the Ministry of Religious Affairs. For the sake of educational continuity, MA Sains was established

⁶ Muhammad Abror Rosyidin, "INTERAKSI PESANTREN DENGAN SAINS DAN TEKNOLOGI," *TA'DIBUNA: Jurnal Pendidikan Agama Islam* 4, no. 1 (25 Mei 2021): 53–73, <https://doi.org/10.30659/jpai.4.1.53-73>.

⁷ Rosyidin.

⁸ "Sejarah SMP Sains Tebuiireng," *SMP Sains Tebuiireng* (blog), 28 Oktober 2024, <https://www.smpsains-tebuiireng.sch.id/2020/09/sejarah-smp-sains-tebuiireng.html>.

in 2023 as a continuation so that students who have already entered the MTs level can progress further. For that reason, the institution now focuses on the integration of Islamic education and natural sciences under the auspices of the KH. M. Hasyim Asy'ari Tebuiireng Foundation, consisting of 4 units, namely SMA Trensains, SMP Sains, MTs Sains Salahuddin Wahid, and MA Sains. Two units are located at Pondok Tebuiireng Jombok and two at Pondok Tebuiireng Kesamben.

INSTITUTION PROFILE

SMA Trensains Tebuiireng

One of the educational facilities at Pesantren Tebuiireng is SMA Trensains Tebuiireng, which was founded by Dr. (HC). Ir. KH. Salahuddin Wahid, who was the caretaker of Pesantren Tebuiireng during the seventh period. This educational institution was established with the great hope of creating a generation that excels in the field of natural sciences; a generation that can use the Qur'an as an epistemological basis in the development of science, as well as a generation that possesses philosophical depth and moral integrity. To achieve this goal, Pesantren Tebuiireng collaborates with Prof. Agus Purwanto, D.Sc., a scientist working in the field of theoretical physics at the Sepuluh Nopember Institute of Technology (ITS) Surabaya, who is also the initiator of the Science Pesantren concept (Trensains). The former Minister of Religious Affairs of the Republic of Indonesia, H. Lukman Hakim Saifuddin, inaugurated this educational institution on August 23, 2014. This educational institution uses the concept of "Trensains" in its teaching, as its name suggests. The General Secondary School applies the concept of "Trensains," which aims to thoroughly study natural sciences through learning, scientific research, and scientific experiments, based on 800 *kauniyah* verses. However, from the school's perspective, this institution is a school that not only combines pesantren material with general knowledge as done by modern pesantren. Trensains focuses on the understanding of the Qur'an, Hadith, and natural sciences (natural science) as well as their interrelationship. Lastly, the interaction between religion and science is a characteristic of Trensains that is not found in contemporary pesantren schools. The concept proposed by Prof. Agus Purwanto, D.Sc. about placing verses of the Qur'an as a source of knowledge (epistemology of science) in discussions about the development of the Islamization of modern science has been implemented at SMA Trensains Tebuiireng. The purpose of curriculum development at SMA Trensains Tebuiireng is to facilitate the implementation of that concept and fulfill the mandate of the law.

Educators at SMA Trensains Tebuireng mostly come from state universities (PTN), holding bachelor's (S1), master's (S2), and doctoral (S3) degrees. They receive direct guidance from the founder of Trensains, while the expert consultant in the field of curriculum for SMA Trensains Tebuireng, Prof. Dr. H. Suyono, M.Pd., is a professor at the school. The Universal Curriculum, developed by the curriculum development team of SMA Trensains Tebuireng in collaboration with the Trensains founders and the curriculum development team from FMIPA UNESA, is a unification of the national curriculum, international curriculum, and the Science Pesantren Wisdom Curriculum (MPKPS). The universal curriculum of SMA Trensains consists of two main groups of subjects (as found in the national curriculum) and one group of subjects on Pesantren Science Wisdom (MPKPS), also known as trensains tools. MPKPS is a subject designed to enhance students' abilities, especially to achieve the school's Vision and Mission. This subject is based on the wisdom of pesantren science and its competencies. Although using the "Universal Curriculum," SMA Trensains Tebuireng follows the official regulations (2013 curriculum).⁹

Science Middle School

SMP Sains Tebuireng was established in 2018 by Dr. (H.C.) Ir. KH. Salahuddin Wahid, the 7th caretaker of Pesantren Tebuireng. Gus Sholah hopes that from this school, Muslim scholars who are faithful to the Qur'an and exhibit good behavior will emerge, capable of coloring the world's civilization. To realize these aspirations and hopes, hard work and cooperation from all parties who care about the greatness of the Qur'an are necessary, as it requires in-depth study at all times and eras so that the advancement of knowledge always remains within its framework, not deviating from the path and lines that have been comprehensively outlined in the Qur'an. Graduates of SMP Sains are expected to achieve the following after becoming accustomed to Teaching and Learning Activities (KBM) at school: a. Have good character; memorize Juz 29 and 30 and selected surahs; memorize Hadith Arbain Nawawi; communicate fluently in English; master the ability to write Arabic correctly and accurately, and be accustomed to conducting science experiments.

SMP Sains has the following goals; (1) achieving 100 percent of seventh-grade students memorizing Juz 30, (2) achieving all eighth and ninth-grade students

⁹ "SMA TRENSAINS TEBUIRENG - Sintesis Sekolah Menengah Umum Dengan Pesantren," diakses 7 Desember 2024, <https://www.smatrensains.sch.id/>.

memorizing Juz 30 and 4 selected surahs overall, (3) ninth-grade students successfully memorizing Hadis Arbain in full, (4) at least three projects strengthening the Pancasila student profile being carried out in one year, (5) the establishment of a canteen focused on honesty, (6) in one year, no cheating in exam implementation, (7) seventy percent of subjects integrated with the Qur'an and/or Hadith being achieved, (8) extracurricular activities such as Scouts, Science Club, English Club, Olympiad Class, Banjari, KIR, Nature Lovers, Aeromodeling, Football, and Basketball, (9) all teachers using blended learning, (10) half of the teachers using project-based, problem-based, inquiry-based, and discovery-based learning models achieving the expected results, (11) participation in the top ten national and international competitions in the field of science and technology, and (12) collaboration with national and international educational institutions ("History of SMP Sains Tebuireng" 2024).¹⁰

MTs Sains Salahuddin Wahid and MA Sains Tebuireng Putri Kesamben

Under the auspices of Pesantren Tebuireng, MTs Sains Salahuddin Wahid is an educational institution specifically for girls after successfully establishing the Trensains Senior High School (SMA Trensains) and the Science Junior High School (SMP Sains) in Jombok, KH. Salahuddin Wahid, also known as Gus Sholah, decided to establish a similar school. They will offer a curriculum that combines the Ministry of Religious Affairs curriculum, the pesantren curriculum, and a special science-based curriculum so that everything is integrated into the students' learning. The institution was established on land donated by Mr. Ir. Soedigno and Mrs. Setiowati, located on the Kesamben-Sumobito road, Kesamben Village, Kesamben District, Jombang Regency. One of the junior high school-level institutions in Indonesia, MTs Sains Salahuddin Wahid, is intended for female students. This institution develops multiple intelligences so that madrasahs and pesantrens can meet the interests and talents of students. Initially, this institution was called MTs Sains Tebuireng. However, to honor the contributions and hopes of KH. Salahuddin Wahid as the founder, its name was changed to MTs Sains Salahuddin Wahid.

According to Mr. Ainur Rofiq S,T M. Pd. I, the head of MTs Sains Salahuddin Wahid, and the school is still categorized as a new institution. However, in its first cohort from 2019 to 2020, MTs Sains Salahuddin Wahid became the

¹⁰ "Sejarah SMP Sains Tebuireng."

third-place winner at the district level and ranked in the top ten in mathematics. In addition, he provided an explanation of the flagship programs of the University of Science Salahuddin Wahid, including the values of pesantren character, pesantren-based science, the Qur'an, hadith, ijma' of scholars, and other scientific texts that can be studied and applied in science. In addition, there are specialization programs that include *tahfidz* classes, yellow book classes, English classes, and Arabic classes. The students are expected to master skills such as reading and writing the Qur'an, mastering foreign languages (Arabic and English), understanding journalistic science, including the ability to compose scientific papers (KTI), and understanding basic natural sciences derived from the universal verses in the Qur'an.

All of this is intended to achieve the goal of creating a generation that is noble in character, knowledgeable, and has a leadership spirit. MTs Sains Salahuddin Wahid was established to accommodate and nurture the interests and talents of students in the field of basic natural sciences. This school was established with the aim of allowing the students to develop science while still emphasizing noble character. Then, to continue the same sustainable vision and mission, Tebuireng established MA Sains in the same place in 2023. That sustainability is very necessary for the continuity of the science being taught. The MTs level serves as a foundation for the growth of basic scientific knowledge, while the MA level serves as a more in-depth and flexible development related to science and religion, particularly the Quran.¹¹

The Relationship Between Religion and Science

Islam demands that humans explore all existing potentials, especially in the field of knowledge. The first religious command in the Quran is *iqra'* (read), which is evidence that Islam highly values the process of intellectuality, science, and knowledge. Moreover, there are several admonitions from Allah in the Quran to humans who do not use their intellect in seeking the truth, such as *afala ta'qilun*, *afala tatafakkurun*, *afala ta'lamun*, *afala tubshirun*, *araiata*, etc. Those expressions show God's support for knowledge over His creation, and the potential given to humans who are considered *ahsani taqwim* (the best existence). For that reason, in the philosophy of Islamic education, the Quran and Hadith, as the primary sources used as the foundation for human development, must be dialogued with reason as a

¹¹ Ainur Rofiq, Wawancara Kepala MTs Sains Salahuddin Wahid, Oktober 2024.

complementary tool that accompanies the process of human life, so that it can develop throughout history.

The relationship between religion and science in its development, at least, has 4 patterns of relationship. First, religion and science are related in conflict. In history, during the Dark Ages of the West when Ancient Rome fell in 476 AD the Eastern Roman Empire (Byzantine) replaced its power, marking the end of the ancient era and the beginning of the medieval era. The hegemony of the church became the only major power. The Church, as a symbol of religion, became the main power, which could not be contradicted, without dialogue, and without discussion. Here, the church then made its opponents into individuals and groups who were heretics and had to be eradicated, just like Galileo Galilei, who was executed for opposing the flat Earth theory proposed and believed by the church. Religion, which in ancient Greece supported science, was replaced by the church which did not support the pursuit of knowledge.

As a result of the conflict between the religious community and the scientific community, the theory of independence between science and religion emerged. This anti-conflict theory emerged as a result of the intense struggle between religious groups and scientists or scholars. This theory of the relationship between religion and science proposes an alternative separation between the two. Religion and science each have their own truths with standards determined by each.

Third, this emerging approach suggests a relationship between religion and science in a more constructive interaction rather than a relationship based on conflict and independence. It is acknowledged that religion and science have many similarities and can even help each other. The dialogue conducted compares religion and science by emphasizing that there are similarities and differences in methods and concepts for prediction. This method assumes that religion and science are indirectly related, so they can be placed within a framework of friendship. The dialogue between religion and science offers options for cooperation because there are limits to the questions.

Fourthly, a more constructive approach is the integrative one between science and religion, where both have an intimate relationship that is interconnected with each other. This interconnection is more about the mutual need between the two; science without religion cannot expand its reach, while religion without science cannot develop human civilization. The integration of religion and science involves three sub-approaches. *First*, natural theology, believes that some attributes of God can only be known through sacred texts, while the existence of God itself can only be known through reason. Science helps to prove the existence of God. *Second*, is

the theology of Nature, which believes that there is a deadlock in religion in understanding science or vice versa, leading to contradictions. Therefore, it needs to be redefined so that a synergy can be found. *Third*, systematic synthesis demands a metaphysical elaboration between religion and science comprehensively.¹²

Seeing this, integration has a more dialogical relationship and enlightening discussions compared to other approaches. The dialogue conducted does not merely seek justification, but rather an elaborative level of mutual benefit between the two. That is what is intended by the Quran in several of its commands to study knowledge, such as the word *iqra'* in Surah Al-Qalam. Many people interpret *iqra* as "read," but more deeply, *iqra* is related to *istiqla'* (research), and it is more accurately understood as "examine carefully." There is a missing object (predicate) in it, namely *ma kaana wa maa yumkinu kaunuhu* or *al-kaun wa imkanul kaun*, which means everything that exists and everything that is possible to exist. Searching for what is possible cannot be done without the role of reason and knowledge in it, leading to the emergence of research and experimental proof being conducted. Here lies the integration of religion and science in Islam, where religious support for the development of science is very strong, especially with the indication that 800 verses or 12% of the Quran's content are suspected to have scientific elements.

Agus Purwanto divides the relationship between Islam and science into three categories: Islamization of Science, Scientification of Islam, and Islamic Science. The goal of the Islamization of Science is to ensure that modern scientific discoveries, which mostly occur in the West, can be in accordance with Islamic teachings. Meanwhile, Islamic Science seeks to make the Qur'an and the Sunnah the foundation of knowledge. Of the three models, Agus Purwanto believes that the Islamic Science model is the most effective because it will contribute more significantly to the advancement of science in the future. Epistemologically, axiologically, and ontologically, Islamic science is built on the paradigm of revelation. The ontology of Islamic science views reality as not just material (QS. al-Haqqah (69): 38–39), the axiology of Islamic science makes humans increasingly submit, draw closer, and fear Allah, and become more amazed by the patterns of His creation (QS. al-Fatir (35): 27–28).¹³

¹² Heri Taufik Ismail, Irawan Irawan, dan Tedi Priatna, "Hubungan Antara Agama Dan Sains," *Jurnal Budi Pekerti Agama Islam* 2, no. 4 (12 Juni 2024): 206–13, <https://doi.org/10.61132/jbpai.v2i4.462>.

¹³ Agus Purwanto, *Ayat-Ayat Semesta, Sisi-Sisi al-Quran yang Terlupakan* (Bandung: Mizan, 2015), 185–86.

In the meanwhile, Muslims believe that only a select few read and commit to memory of the Quran. Few people also know what it means. In order to build a science whose epistemological foundation is the Quran, it should continue to investigate and study what the meaning of the Quran is. For instance, *Surah Al-Baqarah*:164 is one passage that has around ten indications of science:

إِنَّ فِي خَلْقِ السَّمُوتِ وَالْأَرْضِ وَاخْتِلَافِ اللَّيْلِ وَالنَّهَارِ وَالْفُلْكِ الَّتِي تَجْرِي فِي الْبَحْرِ
بِمَا يَنْفَعُ النَّاسَ وَمَا أَنْزَلَ اللَّهُ مِنَ السَّمَاءِ مِنْ مَّاءٍ ۖ فَأَحْيَا بِهِ الْأَرْضَ بَعْدَ مَوْتِهَا وَبِ
ثَ فِيهَا مِنْ كُلِّ ذَاةٍ ۖ وَتَصْرِيفِ الرِّيْحِ وَالسَّحَابِ الْمُسَخَّرِ بَيْنَ السَّمَاءِ وَالْأَرْضِ
لَآيَاتٍ ۖ لِّقَوْمٍ يَعْقِلُونَ

"Indeed, for those who comprehend, the creation of the earth and the heavens, the alternating day and night, the ships that carry goods that are good for humanity, the water that Allah sent down from the heavens to revive the earth after it had died of drought, the spread of all kinds of creatures on it, and the shifting of the winds and clouds between the heavens and the earth are all indications of Allah's greatness".

The words "*Inna Fi khalqis samawati Wal ardhi*" discusses cosmology, or the origin of the cosmos. Because it has to do with the sun and the moon, "*Wa ikhtilaafi al-layli wa an-nahaar*"—the alternating day and night—has a connection to astronomy. According to Archimedes' principle, which is the law governing the upward buoyant force when an item is submerged in a fluid (liquid or gas), "*wal fullkillati fil bahri*" refers to ships that are able to travel on water or the ocean and float gas). "*Bimaa yanfaunnasa*" refers to economic operations that bring several products and advantages; this is connected to the dynamics of transportation and commerce. "*Fa aahya bihil ardho ba'da mautiha*" refers to the resuscitation of the dead, such as dried and dead grass that resurrects, whereas "*Wama anzalu minas samaa in maa in*" refers to rain falls, which are connected to hydrology. logic. These are the true indicators, but we just interpret them and don't think they need to be investigated or analyzed companion. There may be several viewpoints when it comes to interpretation.¹⁴

Research never ends with a single conclusion. consistently. A single passage might be the focus of much study of nature. For instance, the lens of Quranic

¹⁴ Umbaran, Wawancara dengan Kepala SMA Trensains Tebuieng, Oktober 2024.

analysis of Surah An-Naml was used to experiment with two terms for male and female ants that need to be studied *an-Naml* (The Ant). The Quran also mentions ginger (*zanjabil*), and it is necessary to consider why it is stated. That indicates that something must need to be examined. Look we are aware of ginger's various health advantages. Those scientific passages receive less attention in Islamic society. Muslims who study the scientific content of the Quran are no more worried than non-Muslim Westerners, despite being the proprietors of the sacred text of The Quran.

The Integration System of Islamic Education and Science at Pesantren Tebuireng

In the educational process at SMA Trensains, there are three relationships between religion and science. *First*, the sanctification of Islam leads to the conclusion that Islam is very scientific and scholarly. There is not a single teaching of Islam that contradicts science. Anything that is prohibited by the Quran or Hadith surely has its benefits, except when violated, it will definitely have its harms or effects, such as the consumption of alcoholic beverages, adultery, and others. That's called the sanctification of Islam, so Islam is truly scientific.

Second, the Islamization of science, means that existing science is attempted to be expressed in religious language. It can be done by relating it to the Quran and Hadith. It can also be done by changing the names in science, such as physics to *fiziyya*. With that, maybe they could accept it if it is named with an Islamic name.

Third, the integration of science and Islam, making the Quran and Hadith the basis/source of science. One verse of the Quran that is alleged to contain scientific meaning is then researched. This is what the founders of science desired. Unlike points one and two, which have indeed become part of it. The last point is actually what was used by Muslim scholars in the past when they adopted methods or tools from the Greeks. Whereas now, Europeans or Westerners are breaking the chain or there seems to be a missing link between them and Islam. They (the West) claim that the Islam they use originates from Greece, and there is an effort to reduce the role of the Umayyad, Abbasid, and Fatimid Muslims.¹⁵

Epistemologically, SMA Trensains includes a science clause that is actually very Islamic. Even though people say it is quite risky, it is still carried out, especially concerning the third point, which is the Integration of Science and Islam, that must be possessed by Muslims, in addition to mastering other chapters in religion. In

¹⁵ Umbaran.

addition to memorizing and mastering the Quran and Hadith along with their interpretations, a Muslim should also have scientific research methods, so they can break down verses, conduct research, and produce the desired scientific results. All this time, science has been separated from religion for a long time, and one of the missions of SMA Trensains is to reconnect the points that have been separated. Islam believes that the universe is the creation of Allah, and the Quran is also the word of Allah. Therefore, there can be no contradiction because the producer or source is the same. Like a car factory, the one that makes the manual and the one that makes the car itself cannot be different. It means that although the scientific foundations of the two are different, they cannot be separated despite their differences.

To support that great aspiration, SMA Trensains has 4 subjects that attempt to reunite science and religion, which are not found in other schools, namely (1) Falaq Science. Falaq Science is a lesson about astronomy that combines religion and science. Then (2) Quran-Science, followed by (3) Astrophysics, and (4) Philosophy. Philosophy is used as a tool for students to develop critical thinking and systematic reasoning. So that is what SMA Trensains uses to bridge the gap between these two factions. Nowadays, if a child wants to focus on religion, the advice is definitely to enter MI, MTs, Aliyah, UIN, etc., while those interested in general subjects are directed to SD, SMP, SMA, and public universities. In fact, it should be possible to study religion while also studying science; they can be combined and should not be separated. With those four subjects, SMA Trensains hopes to strive to reunite and reintegrate science with religion.

There are several activities that support this process, one of which is a guest lecture inviting expert practitioners from renowned universities such as ITS, ITB, UM, and others, to give guest lectures to the students. In addition, the students also discover new things and are motivated to be like the speakers. Next, there is also a full moon observation activity in Kenjeran, Surabaya. So if rukyatul hilal is still very difficult to see small and distant objects, instead of observing rukyatul hilal which is quite challenging, the students are invited to do easier observations first. However, it is not just about observing but also calculating when the full moon rises, at what time, its position, how long, etc. This is also part of the application of the four subjects mentioned earlier, namely astrophysics and astronomy.

In addition to the four characteristic science subjects, there are also extracurricular activities that support the scientific interests and talents among the students, such as the MIPA extracurricular, Earth Science extracurricular, and

astronomy.¹⁶ Another thought arises that if the high school level is not strengthened with a scientific foundation and interest, it will result in a lack of readiness in understanding the material.

Thus, Tebui reng established a Science Junior High School as a foundation to strengthen the science base before they are pushed in high school. The main task of this junior high school is to enhance the interest and knowledge of students in the field of science, as well as other supporting sciences, such as the Quran, Hadith, and Arabic grammar, such as *Nahwu* and *Sharaf*. To achieve this, SMP Sains creates a pleasant learning environment that stimulates students to become more deeply interested in science. Therefore, in light of that goal, SMP Sains sees that Science and Mathematics are the two most needed subjects, so it is necessary to strengthen these two subjects. The most important aspect of organizing SMP Sains is the foundation in learning Mathematics. Mathematics is a subject where, upon graduating from elementary school, students often do not have a solid foundational understanding, so SMP Sains helps ensure they strengthen that foundation alongside other subjects. In addition, what needs to be strengthened is Arabic and its grammar.

The problem is, at SMA Trensains, not all graduates come from Islamic-based junior high schools, so some of those who enter SMA Trensains do not have a strong foundation in Arabic. In fact, to study and analyze the Quran, a student must understand Arabic. In addition to Arabic, English is also needed as an international language and for cross-communication at the global level. These two languages have been strengthened from grade 7 to grade 9.

In addition, besides strengthening Science and Mathematics and Foreign Languages, it is also necessary to make children comfortable with science. Teachers often introduce scientific experiments related to physics, biology, and chemistry so that children realize that learning science is not just about learning formulas but also about conducting experiments related to science.

One of the visions of SMP Sains is to integrate all subjects with the Quran and Hadith. So far, what SMP Sains has been striving for is to find the basis of Hadith or Quranic verses for all subjects. For example, in the Indonesian language, there is a lesson about procedural texts. Then, how to relate it to the Quran, the teacher must find examples of procedural texts in the Quran. For example, the Day of Judgment does not happen suddenly; there are stages to it. So far, that is what SMP Sains has done, even though they are learning Indonesian, there is a

¹⁶ Umbaran.

connection with the Quran. However, at the middle school level, it cannot be delved deeper, because not all teachers are capable of explaining the interpretation of Quranic verses. Moreover, the students are not yet at the stage for such in-depth study; the task of the Science Middle School is only to lay the foundation and spark their interest in science.¹⁷

Not stopping there, Pesantren Tebuireng also continued the effort to integrate Islamic education and science by establishing MTs Sains Salahuddin Wahid, followed by MA Sains, located on the border of Jombang and Mojokerto, specifically in Kesamben District, Jombang Regency. Two units within this local pesantren are specifically designated for female students. The goal is to create future female scientists who will color the world of science in the future.

What differences arise in the process of integrating religion and science at Pesantren Sains Jombok and Kesamben? MTs and MA Sains were established with the hope of focusing on the Quranic sciences and the Arabic language. SMA Trensains is a finished product created by Prof. Agus Purwanto, and there was even an SMA Trensains in Sragen before. Meanwhile, the concept of a science-based madrasah + pesantren was originally the idea of KH. Salahuddin Wahid wanted further development of the science pesantren, where Islamic knowledge must be strengthened, not just focusing on science lessons and materials. What distinguishes the science madrasah in Kesamben is the creation of the Al-Qur'an–Science curriculum. So, how the Al-Qur'an speaks about sciences.

Second, the science lessons taught are not only theoretical as in other institutions but also include applied science education. So, for example, if students are taught about gravity, they are also taught about its function and how it is applied in everyday life. MTs-MA Sains also does not wish to focus solely on results, as per the founder's will, Gus Sholah, which emphasizes focusing on progress. It appears more flexible than SMP Sains-SMA Trensains in the application of the curriculum. MTs-MA Sains tends to respond to the progress of each child, so the standard values obtained by the students are not an issue.

Meanwhile, SMP Sains-SMA Trensains has high standards, even from the very beginning, such as requiring a certain level of IQ. If we put it in percentage terms, the progress achieved by the institution in Kesamben has reached approximately 70% of the target. This figure is based on the learning outcomes and progress achieved by each child. For example, we have targeted the D group students to stay in that group for a maximum of 6 months, and if we look at it, almost all the

¹⁷ Khoirul Anam, Wawancara Kepala SMP Sains Tebuireng, Oktober 2024.

D group children have moved up to the C group within 3 months. Similarly, we have targeted the C group children to stay in that group for a maximum of 1 year, but on average, all the C group children have moved up to the B group within 6 months. MTs Sains has only graduated students twice.

From the first batch, we graduated 42 students. Out of those 42 students, 32 were accepted into SMA Trensains. These 42 students were previously not accepted into SMP AWH or SMP Sains. So, it can be concluded that almost 80% of the students were able to continue to a school that had previously not accepted them. In the second batch, a 50% achievement was reached, with 19 out of 61 graduating students being accepted into SMA Trensains. The principle used by MTs-MA Sains is the fact that almost all Muslim scientists are fundamentally scientists, so there are no religious experts who cannot do science. Likewise, a philosopher must be able to do mathematics. So, basically, to become a scientist, whether a religious scholar, a science expert, or a scientist in any field, it cannot be separated from science. Because science is the foundation for thinking logically and critically. Muslims must not forget that all knowledge comes from Allah SWT. Therefore, we need to learn from the Qur'an first. Because the Qur'an is the source of knowledge. So, it is not about studying knowledge and then looking for its proof, but rather starting with the proof and then deriving knowledge from it.¹⁸

The Relationship Between the Integration of Science and Islamic Education with the Vision of Indonesia Gold 2045

The role of integrating Islamic education and science is very important in shaping individuals who are balanced both spiritually and intellectually. Through this integration, students will not only acquire knowledge of general science but also understand the moral and ethical values taught in Islam. Thus, they can become a generation that is not only academically intelligent but also upholds religious values in their daily lives.¹⁹

With the integration of Islamic education and science, students will be able to see the relationship between knowledge and their religious beliefs. They will learn how to use scientific knowledge to understand and apply religious teachings in their

¹⁸ Ahmad Mudhfar, Wawancara Kepala Pondok Tebuieng Kesamben, Oktober 2024.

¹⁹ Ainul Azhari dan Husnul Hotimah, "FILOSOFI PENDIDIKAN AGAMA ISLAM MENURUT AL-GHAZALI: : Integrasi Spiritualitas Dan Pengetahuan," *ISLAMIKA* 18, no. 01 (18 September 2024): 62-70, <https://doi.org/10.33592/islamika.v18i01.5107>.

daily lives. In addition, this integration can also help students develop critical and analytical thinking in understanding complex contemporary issues.²⁰

Thus, the integration of Islamic education and science not only provides knowledge but also shapes strong character and personality in individuals. For example, in physics lessons, students can learn how scientific principles such as the laws of motion can be used to understand the wonders of Allah's creation in the universe. They can also learn how modern technology, such as drug development, can be used to care for fellow humans in accordance with the teachings of compassion in Islam.²¹

In addition, the integration of Islamic education and science can also help create a deeper understanding of ethical and moral values in various aspects of life. For example, in biology lessons, students can learn about the importance of preserving the environment as a form of responsibility as stewards of the earth. They can also understand that science is not only about knowledge, but also about moral responsibility in using that knowledge for the common good. Thus, the integration of Islamic education and science can help create a generation that is intelligent, morally upright, and responsible in living life in this world.²² With the integration of Islamic education and science, students will also be trained to always refer to religious teachings in making decisions and taking actions. This will help create a generation that is not only intellectually smart but also possesses good morals and ethics in all aspects of life.²³

Thus, Indonesia can prepare a generation ready to face challenges and build a better future in line with the vision of Indonesia Gold 2045. Consequently, Indonesia Gold 2045 will not only be a dream but also a reality that can be realized through collective efforts in creating a generation that is excellent and has integrity. Through holistic and integrated education, it is hoped that each individual will

²⁰ Mona Hijriah Nasution dan Salminawati Salminawati, "Pengaruh Modul Ilmu Pengetahuan Alam Berbasis Integrasi Islam Dan Sains Terhadap Hasil Belajar Pada Siswa Sekolah Dasar," *Jurnal EDUCATIO: Jurnal Pendidikan Indonesia* 10, no. 1 (28 Juli 2024): 462–72, <https://doi.org/10.29210/1202424378>.

²¹ Zainol Hasan dkk., "Menggagas Pendidikan Islam Holistik Melalui Integrasi Ilmu Pengetahuan Dan Spiritualitas," *Global Education Journal* 2, no. 1 (5 Maret 2024): 81–89, <https://doi.org/10.59525/gej.v2i1.321>.

²² Faizin Faizin, Joni Helandri, dan Supriadi Supriadi, "IMPLEMENTASI NILAI-NILAI PENDIDIKAN ISLAM DALAM KONTEKS MODERN: TINJAUAN TERHADAP PRAKTIK DAN TANTANGAN," *TA'LIM : Jurnal Studi Pendidikan Islam* 7, no. 1 (27 Januari 2024): 93–116, <https://doi.org/10.52166/talim.v7i1.5742>.

²³ Umar Sidiq dan Wiwin Widyawati, *Kebijakan Pemerintah terhadap Pendidikan Islam di Indonesia* (Ponorogo: Nata Karya, 2019).

continuously develop their potential to provide positive contributions to the nation and the state.²⁴

Therefore, it is important for all parties to support the Indonesia Gold 2045 program by paying more attention to the field of education, especially in uniting religious values and scientific knowledge to create a resilient and morally upright generation.²⁵ Education is the key to achieving these great aspirations, so collaboration between the government, society, and the education sector is necessary to create a conducive learning environment. In addition, the role of parents is also very important in shaping children's character to have high morality and optimal abilities. Thus, the vision of Indonesia Gold 2045 can be achieved through comprehensive and sustainable joint efforts.²⁶

The Indonesia Gold 2045 Vision is a program aimed at making Indonesia a developed and highly competitive country by 2045. To achieve this vision, efforts are needed to improve the quality of human resources so they can compete in the era of globalization. Through quality education and supported by the proactive role of parents, Indonesia can produce a superior generation ready to face future challenges. With strong collaboration between the government, society, and the education sector, Indonesia can achieve its dream of becoming a golden country by 2045.²⁷

The points of the Golden Indonesia 2045 vision are technological innovation, modern infrastructure development, improvement of community welfare, and sustainable environmental protection. All parties must work together to achieve this vision, maintaining unity and the spirit of mutual cooperation. With

²⁴ Ahmad Pihar, "Modernisasi Pendidikan Agama Islam Di Era Society 5.0," *Book Chapter of Proceedings Journey-Liaison Academia and Society* 1, no. 1 (28 April 2022): 1-12.

²⁵ Sozanolo Zamasi dan Elfin Warnius Waruwu, "Partisipasi Guru Agama Kristen Terhadap Pendidikan Dalam Mewujudkan Visi Misi Indonesia Emas 2045," *Jurnal Magistra* 2, no. 1 (22 Maret 2024): 172-88, <https://doi.org/10.62200/magistra.v2i1.97>.

²⁶ Celyna Isaeni Septia Puspa, Dini Nur Oktavia Rahayu, dan Muhamad Parhan, "Transformasi Pendidikan Abad 21 Dalam Merealisasikan Sumber Daya Manusia Unggul Menuju Indonesia Emas 2045," *Jurnal Basicedu* 7, no. 5 (1 Desember 2023): 3309-21, <https://doi.org/10.31004/basicedu.v7i5.5030>.

²⁷ Muhamad Rafly Kurniawan dkk., "Membangun Ibu Kota Negara Nusantara (IKN) Baru Yang Berlandaskan Pancasila : Menuju Indonesia Emas 2045," *Nusantara: Jurnal Pendidikan, Seni, Sains Dan Sosial Humaniora* 2, no. 01 (20 Mei 2024), <https://journal.forikami.com/index.php/nusantara/article/view/670>.

determination and hard work together, Indonesia can become a highly competitive country and an example for other countries around the world.²⁸

From several points of the vision, the one related to the integration of Islamic education and science is the development of modern infrastructure. This is important to ensure that Islamic education and science can be accessed by all layers of society in Indonesia. With the integration of Islamic education and science, Indonesia can create a generation that excels and is highly competitive in the era of globalization. Through cooperation between the government, educational institutions, and society, the vision of Indonesia Gold 2045 can be successfully achieved. In addition, the integration of science and Islamic education is also important for technological innovation and the development of science in Indonesia. By combining religious values and science, the younger generation of Indonesia will be able to become agents of change that lead the country towards a better direction. With the support of modern infrastructure, students will have easier access to develop skills and knowledge in both fields. Thus, Indonesia can compete and contribute on the global stage by having high-quality and highly competitive human resources.²⁹

However, achieving that is not easy, as challenges are also right in front of us. Gus Sholah said that if the goal is to inspire, that's fine; however, it must be based on reality. To realize the "golden generation," we must address many issues. We can mention several problems, such as malnutrition, drugs, smoking, poor education due to the low quality of teachers, a national character that is less supportive, low honesty among students, violence against children, and early marriage.³⁰

Science Pesantren towards Indonesia Gold 2045

Regarding the concept of pesantren and science schools in Tebuireng, according to Umbaran, it is indeed very much in line with the vision of Indonesia Gold 2045. The science-based school and pesantren in Tebuireng feel the need to produce a generation that firmly holds onto the Quran, loves and develops science,

²⁸ Telisa Aulia Falianty, "Adaptasi Kebijakan Moneter dan Sektor Keuangan di Era Dekarbonisasi, Digitalisasi, Multipolar Currency, dan Transformasi: Menuju Indonesia Emas 2045" (Jakarta: Universitas Indonesia, 2023).

²⁹ Syahraini Tambak, *Pendidikan Islam, Konsep Metode Pembelajaran PAI* (Yogyakarta: Graha Ilmu, 2014).

³⁰ Salahuddin Wahid, "Indonesia 2045," *Tebuireng Online* (blog), 22 April 2018, <https://tebuireng.online/indonesia-2045/>.

possesses philosophical depth, and prioritizes *Akhlak*. These four pillars cannot be chosen individually; all four must be present in a student at the Science Pesantren.

Regarding holding steadfast to the Qur'an, this is the primary duty of a Muslim, and it also serves as the basis of epistemology and the source of knowledge that is used as such. Second, loving and developing science, actually, it is not just about loving it but also developing it. Not only mastering it, but also being expected to discover new things. Not just completing the education process and then being called great. Not only stopping there, but also developing science. Because later, the era will definitely continue to evolve. If we don't run, if we don't walk, if we don't move, we will surely be left behind. We might just become spectators when there is a new discovery, and it turns out it was already in the Qur'an, but we did not take part in that discovery. Now we must strive to be pioneers as well as producers. Because a developed nation, a high and advanced civilization, must have a mindset of being producers, not consumers. Therefore, if Pesantren Sains Tebuireng wishes to contribute to Indonesia Emas 1945, and it is very potential, it must continue to make sustainable improvements and significant incremental developments in every step forward, as the adage goes, "whoever delves into knowledge, Allah will grant him new knowledge."³¹

Indonesia Emas 2045 is indeed a vision to welcome the demographic bonus. However, beyond that, this must be seen in terms of which is more predominant and fulfilling, between the productive generation and the non-productive generation. Whether we like it or not, pesantren must participate in filling it. If the pesantren does not participate, there is concern that many generations will be busy working and creating, but without involving God in their work. So, later on, with various positions being offered and the increasing number of productive generations, possibly also in the field of science and technology, there must be students who fill these roles. Santri must instill a religious-scientific influence that impacts the thinking patterns of society and inspires others. However, until now, there are indeed not many pesantren that study science in depth. On average, pesantren indeed focus on providing education in Islamic law and jurisprudence (*fikih*). But within the concept of Trensains, it is also not permissible to neglect the teachings of *fiqh* and law, because they are also important for religious education. However, the focus on Science and the Quran must not be compromised.

To achieve that, it is not easy. Of course, it requires research and studies. Therefore,

³¹ Umbaran, Wawancara dengan Kepala SMA Trensains Tebuireng.

alumni who are spread across various campuses and institutions, even in other parts of the world, must also be monitored for their contributions to science through their research. Thus, at SMA Trensains, several alumni have produced beneficial research results, such as about antibiotics from cogon grass, and other studies.³²

However, what must be noted is the difference in knowledge and intellectuality accompanied by spirituality and those that are not, which lies in behavior (*akhlak*) and manners. The pesantren teaches its students to bring God into every achievement they make. Becoming a Muslim scientist means acting as a servant of Allah appointed as a *khalifah fi al-ardh* (God's agent to manage the earth) rather than as a destroyer (*muksid fi al-ardh*). The intellectuality that is developed must be constructive, not destructive. This is what should distinguish between a scientist who is a santri and one who is not. So that in the end, knowledge can truly be beneficial for many people, for human development, for education, and for human welfare, not just for money, positions, personal interests, and a group of people, let alone to destroy civilization.³³

CONCLUSIONS

After presenting the data and analysis, the author found several conclusions. First, the Pesantren Tebuireng has 4 units that focus on the integration of Islamic education and science, namely SMA Trensains and SMP Sains in Jombok, MTs Sains Salahuddin Wahid, and MA Sains in Kesamben. SMA Trensains focuses on the development of the integration of science and the Quran, while SMP Sains prepares basic science knowledge, experimental mentality, love for science, mastery of foreign languages (Arabic and English), and basic understanding of the Quran. MTs Sains focuses on the process of continuous improvement in the Quran and Arabic-English language. Meanwhile, MA Sains is still in the development stage, as it is an institution that has only been established for one year.

Secondly, the relationship between science and religion applied by Pesantren Sains Tebuireng is an integrative relationship that mutually requires one another, not merely the Islamization of science or the sanctification of science. Pesantren Sains Tebuireng has high potential in preparing the golden generation towards the Vision of Indonesia Gold 2045, particularly in the fields of technological innovation, modern infrastructure development, community welfare improvement,

³² Rofiq, Wawancara Kepala MTs Sains Salahuddin Wahid.

³³ Anam, Wawancara Kepala SMP Sains Tebuireng.

and sustainable environmental protection. The Golden Generation prepared by Pesantren Sains is one that not only prioritizes intellect and reasoning but is also based on faith, divinity, piety, morality, and usefulness.

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