

TECHNOLOGICAL INNOVATION IN INTEGRATION AND INTERCONNECTION OF SCIENCE IN ISLAMIC HIGHER EDUCATION

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Abstract: Technological progress cannot be hindered because today, education is entering the industrial era 4.0 characterized by education that uses digital technology in the learning process. With the use of this technology, the learning process is not limited to space and time. The terms religious knowledge and general science should not exist. Science is one unit because its source is from the Koran. This study aims to explain technological innovation in the integration and interconnection of science in Islamic higher education. This research is a research library. Therefore, what is done is exploring several data by examining in-depth reference sources from national and international journal articles and reading books relevant to the research. The data collection method that researchers use is by collecting books, articles, journals, and opinions which reveal and study the Interconnection Integration. The study results indicate that the integration and interconnection of knowledge can be achieved if learning refers to the principles of integration between Hadarah an-Nash, Hadarah al-Ilm, and Hadarah al-Falsafah. Technological advances can be used to achieve these goals, such as e-learning, digital learning resources, and teleconferencing.

Keywords: innovation, technological advancement, integration, interconnection

INTRODUCTION

"The world is in your hands" this expression is not entirely wrong but also not wholly accurate. Today, it is very easy for humans to access any part of the world in just a few seconds. Humans can see activities in other countries and even follow the events they hold with only internet and smartphone packages. Many findings make it easier for humans, but some cases threaten humanity. For example, the discovery of fake vaccines by medical experts, nuclear being used as a weapon of mass destruction, and the many phenomena of crimes that are carried out by utilizing technological sophistication. The development of acts of

intolerance, radicalism, and religious studies makes them lose their rationality. Many ustadz practice spiritual teachings in a textual manner, thus giving rise to radical understandings.¹

Technological sophistication has made parents complacent and lets their children use smartphones without supervision. Even children who are still toddlers are given the authority to play with smartphones on the pretext of "to be happy and not fussy." This, of course, adds to the burden of education to become heavier. When educators are trying to form good morals, some smartphones damage the business. It is undeniable that children are more interested in smartphones because creator content is designed in such a way as to make users "interested," regardless of the impact of character and morality, which continues to be degraded. Even though educational institutions always instill character education to build ways of thinking, behaving, and behaving according to religion and the State.²

Technological progress cannot be hindered because today, education is entering the industrial era 4.0 characterized by education that uses digital technology in the learning process. This technology allows the learning process to take place not limited to space and time, meaning that the learning process is not only in the classroom and during study hours. It is indeed homework that is not easy for the world of education, especially in Indonesia. The educational challenge in the era of the industrial revolution 4.0 is in the form of changes in learning, thinking patterns, and how to act of students in developing creative innovations in various fields. The function of the teacher is no longer central in education. Still, it turns into a student-centered where the teacher becomes a facilitator for the provision of students' learning needs to implement "how to learn" by preparing learning resources and media, which are intended not only for students around them but also physically far away.³

Technology will continue to develop with innovations in line with the times and high human intellectual level. On this basis, the meaning of religion must always follow developments in science and technology. This meaning does not mean interpreting the Qur'an and Hadith as the main source of Islamic law in a liberal manner, but how Islam can greet one another and cooperate with other

¹ Syahril Labaso, "Paradigma Integrasi-Interkoneksi Di Tengah Kompleksitas Problem Kemanusiaan," *Al-A'raf : Jurnal Pemikiran Islam dan Filsafat* 15, no. 2 (December 31, 2018), 335.

² Syaiful Rizal and Abdul Munip, "Strategi Guru Kelas Dalam Mumbuhkan Nilai-Nilai Karakter Pada Peserta Didik (Study Kasus: SDN Pondok Dalem 01 Semboro Dan MI Fathus Salafi Ajung Jember)," *Al Ibtida: Jurnal Pendidikan Guru MI* 4, no. 1 (2017), 45-60.

³ Dewi Surani, "Studi Literatur: Peran Teknolog Pendidikan Dalam Pendidikan 4.0," in *Prosiding Seminar Nasional Pendidikan FKIP*, vol. 2, 2019, 456-469.

sciences in interpreting the texts contained in the Qur'an and Hadith. Any scientific building, religion, and science cannot stand alone but requires cooperation, mutual correction, and mutual connection. This is necessary so that humans can help deal with the complexities of their lives so that the complexity of the problems faced can be understood and resolved. If the two cannot be compromised, then what will happen is massive decline, dehumanization, both in the scientific field and in socio-religious life.⁴

There have been wrong views or perceptions developed in the community about what they call religion, religious education, religious studies, and spiritual learning. In their opinion, faith is nothing more than ritual activities, such as zikir, praying, fasting, zakat, hajj, taking care of the corpse, marriage, and the like. At the village government level, the ritual tasks above are related to religious leaders' duties, not those of the village head or state head. So, in their view, religion is a spiritual leader, not ahead of government. The statement above turns out to have an impact on wrong ideas as well as on religious education and religious studies. They call Madrasas, Islamic boarding schools, and Islamic colleges as Islamic religious education institutions. Other than that, they call public education institutions, such as elementary schools, junior high schools, high schools, police academies, nursing academies, and others. This view has an impact on the dichotomy of science. They call fiqh, monotheism, morals, tasawwuf, date, and Arabic lessons as Islamic religious lessons, while studies in Natural Sciences, Social Sciences, and Citizenship Education usually call general studies.⁵

In essence, Islam is not just a religion and not just a matter of ritual. Apart from ritual activities, Islam also talks about science, the quality of human life, justice, and talks about doing good deeds or working professionally. Prophet Muhammad SAW was sent to the world not only taking care of rituals but perfecting morals. In other words, Islam is not only about religion but also civilization. But unfortunately, when talking about Islam, people's imagination exclusively focuses on ritual issues. Supposedly, all aspects related to Islam must be seen as a whole. A person succeeds in carrying out a ritual solemnly because he/she knows himself, other people, nature, and God. To know all that, one must study science in-depth as instructed by Allah SWT through the Qur'an and the hadith of the Prophet. If such an understanding is developed, then all courses

⁴ Zainal Arifin, "Pengembangan Keilmuan Integratif di Universitas Islam Negeri," *insania : Jurnal Pemikiran Alternatif Kependidikan* 19, no. 2 (2014), 385-402.

⁵ Abu Darda, "Integrasi Ilmu Dan Agama: Perkembangan Konseptual Di Indonesia," *At-Ta'dib* 10, no. 1 (2016).

given in Islamic higher education campuses should be interpreted to increase Islamic faith to be pleasing to Allah.⁶

This research is fundamental because as technology develops, humans need to understand, explore, and predict its positive and negative impacts it will cause. Don't let humans become complacent with worldly things, things that prioritize momentary pleasures. Humans must innovate in using technology and integrate and interconnect with science, so there is no dichotomy of science and being left behind. Besides, there are no other articles or studies that discuss in detail technological innovation in the integration and interconnection of science in higher education, for example, articles by Syamsuar and Reflianto about the challenges of technology-based learning. Still, they do not explain the implementation of technology,⁷ as well as articles by Yuyu Yuliati and Dudu Suhandi Saputra about learning science in the industrial revolution era that focuses on science, not the integration and interconnection of science.⁸ Furthermore, Kasinyo Harto's article reveals the challenges of lecturers at the Islamic Religious College in the industrial era 4.0 focus on the challenges faced by educators, not technological innovation.⁹ Then Saeful Anwar's work on how Islam responds to digital technology challenges still focuses on the object of Islam as a ritual, not as integration and interconnection of knowledge.¹⁰

This research is a research library. Therefore, what is done is exploring some data by examining in-depth reference sources from national and international journal articles and reading books relevant to the research. The data collection method that researchers use is by collecting books, articles, journals, and opinions which reveal and study the Interconnection Integration. Furthermore, the researcher conducted an in-depth analysis to process the data obtained during the study to conclude. The data analyzed is then presented with a deductive method that departs from general theory to reach a conclusion that answers the formulation of this research problem.

⁶ Imam Suprayogo, *Menghidupkan Jiwa Ilmu: Kumpulan Kolom Seputar Pendidikan* (PT. Elex Media Komputindo, 2014), 302.

⁷ Syamsuar Syamsuar and Reflianto Reflianto, "Pendidikan Dan Tantangan Pembelajaran Berbasis Teknologi Informasi Di Era Revolusi Industri 4.0," *E-Tech: Jurnal Ilmiah Teknologi Pendidikan* 6, no. 2 (2019).

⁸ Yuyu Yuliati and Dudu Suhandi Saputra, "Pembelajaran Sains Di Era Revolusi Industri 4.0," *Jurnal Cakrawala Pendas* 5, no. 2 (2019).

⁹ Kasinyo Harto, "Tantangan Dosen Ptki Di Era Industri 4.0," *Jurnal Tatsqif* 16, no. 1 (2018): 1-15.

¹⁰ Saeful Anwar, "Revolusi Industri 4.0 Islam Dalam Merespon Tantangan Teknologi Digitalisasi," *Jurnal Studi Keislaman* 8, no. 2 (2019).

Advances in Industrial Technology 4.0

In the industrial revolution era 4.0, thinking skills are needed to lose their existence as civilized creatures. The current industrial development has had a tremendous impact if humans cannot keep up with the times. These skills are needed so that humans can face the challenges, problems, burdens of life and the economy in this century.¹¹The industrial revolution 4.0 indicates that the industrial revolution occurred four times. The first revolution happened in England in 1784, marked in which steam engines and mechanization replaced human jobs. The second revolution occurred at the end of the 19th century, where production machines powered by electricity were used for mass production activities. The use of computer technology for manufacturing automation starting in 1970 marked the third revolution. The rapid development of sensor technology, interconnection, and data analysis led to integrating all of these technologies into various industrial fields. This idea was predicted to be the fourth revolution. This is a trend of automation and data exchange in manufacturing technology. In this era, the industry is starting to touch the virtual world, human, machine, and data connectivity. Everything is already everywhere.¹²

The industrial revolution 4.0 builds on the 3.0 industrial revolution, also known as the digital revolution, marked by computers' proliferation and automation of records in all fields. Automation in all areas and connectivity are clear signs of the 4.0 industrial revolution. One of the unique characters of the 4.0 industrial revolution is the application of artificial intelligence. This transformation in the 4.0 industrial revolution differs from its predecessors in several aspects. First, innovations can be developed and disseminated faster than ever. Second, there is a significant reduction in production costs and the emergence of a platform that combines several concentration activities in several sectors and increases the aggregate yield. Third, this revolution is taking place globally and will affect, and be shaped by, almost all countries.¹³

Industry 4.0 challenges are as follows: First, information technology security issues. Second, reliability and stability. Third, lack of adequate skills and Fourth, reluctance to change by stakeholders and the loss of a lot of work

¹¹ Muh Syauqi Malik, "Analisis Materi Pokok SBDP MI/SD Kurikulum 2013 Abad 21," *elementary: Islamic Teacher Journal* 8, no. 1 (2020): 59–82.

¹² Surani, "Studi Literatur."

¹³ Ghufron, "Revolusi Industri 4.0: Tantangan, Peluang, Dan Solusi Bagi Dunia Pendidikan," in *Seminar Nasional Dan Diskusi Panel Multidisiplin Hasil Penelitian Dan Pengabdian Kepada Masyarakat 2018*, vol. 1, 2018.

become automation. In contrast to Irianto, who tried to simplify the challenges of industry 4.0, namely: industrial readiness, reliable workforce, ease of regulation of cultural matters, and diversification and job creation. Meanwhile, according to Irianto, there is an innovation in existence, a competitive industrial base, investment in technology, and integration of small and medium enterprises and entrepreneurship.¹⁴

The four design principles for Industry 4.0, namely:

1. Interconnection, namely machines, devices, sensors, and people's ability to connect and communicate through the Internet of Things or the Internet of People. This principle requires collaboration, security, and standards.
2. Information transparency is information systems' ability to create virtual copies of physical copies by enriching digital capital with sensor data, including data analysis and information provision.
3. Technical assistance is the assistance system's ability to port humans by combining and evaluating information consciously to make the right decisions and solve urgent problems in a short time.
4. Decentralized decisions are virtual physical systems' ability to make their own decisions and carry out tasks as effectively as possible.¹⁵

The progress of science and technology is swift, information can be obtained easily, and communication can be established quickly. This era demands collaboration, discussion for problem-solving, and creating a more flexible and efficient atmosphere.¹⁶

Indonesia needs to immediately improve its human resources' capabilities and skills if it does not want to be left behind by technological advances. Especially in terms of education, educators and students should utilize and implement digital and computing technology in the learning process. Learning innovation allows students to find convenience to understand educators' teaching materials by using information technology media. The use of digital media packaged and designed beautifully and interactively can foster enthusiasm and enthusiasm for

¹⁴ Drajad Irianto, "Industry 4.0; The Challenges of Tomorrow," in *Disampaikan Pada Seminar Nasional Teknik Industri, Batu-Malang*, 2017.

¹⁵ Mario Hermann, Tobias Pentek, and Boris Otto, "Design Principles for Industrie 4.0 Scenarios," in *2016 49th Hawaii International Conference on System Sciences (HICSS)* (IEEE, 2016), 3928–3937.

¹⁶ Siti Fatonah and Muhammad Shaleh Assingily, "Quo Vadis Materi Pesawat Sederhana Dalam Pembelajaran IPA Sekolah Dasar Di Era Disrupsi," *Edu Sains: Jurnal Pendidikan Sains dan Matematika* 8, no. 1 (2020), 46–60.

students to learn in their learning environment to increase their understanding of their learning.¹⁷

The efficiency in carrying out educational innovations has an excellent opportunity to create many conducive, enjoyable learning conditions so that learning activities can effectively and efficiently facilitate students to achieve a component that determines the creation of conditions during learning. The study results reveal that several ASIA countries (Hong Kong, Singapore, and Taiwan) have prepared professional educators, namely educators who can use e-learning. This study also explained that educators' ability to use technology is one of the solutions to prepare a competent millennial generation. Of course, this is in line with Menristedikti's opinion about the preparation of responsive, adaptive, and reliable human resources to face the industrial revolution.¹⁸

The fact that many researchers have found in Indonesia is that not all educators are capable of utilizing technology. This is due to the lack of educators' knowledge, age and is still tied to conventional media. Educators' understanding of the importance of using technology in learning is still low. Of course, this is contrary to the expectations set forth to face the industrial era. Judging from education problems in Indonesia, which has remote and isolated areas, educators' lack of skills in using technology will worsen the situation. Educators who are expected to have the technical ability are urgently needed, starting from early childhood educators to educators in universities. It is hoped that educators will have skills in technology so that they will also be able to assist children in utilizing existing technology and be able to facilitate education for the entire community.

One example in early childhood education is that educators who can use technological equipment are also expected to direct children to use gadgets according to the child's development stage, not the other way around. In the end, making gadgets for early childhood does not have an entirely negative impact. Collaboration between educators and parents is also needed in utilizing technological equipment, not only devices, but also computers, laptops, and so on. Therefore, the ability to utilize technology is supported by the readiness of educators and the readiness of parents or those closest to the child.

¹⁷ Muh Syauqi Malik and Aninditya Sri Nugraheni, "Strategi Interactive Digital Learning Untuk Meningkatkan Pemahaman Bacaan Pada Anak Slow Learner," *EduHumaniora| Jurnal Pendidikan Dasar Kampus Cibiru* 12, no. 2 (n.d.), 176–182.

¹⁸ Ching Sing Chai and Siu-Cheung Kong, "Professional Learning for 21st Century Education," *Journal of Computers in Education* 4, no. 1 (2017), 1–4.

Integration and Interconnection of Science

In essence, the interconnection integration paradigm wants to show that the various scientific fields are connected. This is because what the field of science aims for is the same natural reality. It's just that the dimensions and focus of attention seen by each discipline are different.¹⁹ One of the professors initiated the interconnections at UIN Sunan Kalijaga Yogyakarta, namely Prof. Dr. M. Amin Abdullah. The integration-interconnection paradigm assumes that the phenomena of life that humans face and live by are very complex. Whether religious, social, humanities or natural sciences, every scientific building cannot stand alone. An integrated-interconnection approach is needed so that there is no longer a gap between one science and another. Every scientific field needs other scientific areas so that one another dialogue and complement each other.²⁰

The integration-interconnection approach with the aim that the dichotomy that has been formed by history can be resolved. Understanding Islam is not enough from one direction alone but requires a complex and comprehensive approach, namely the integration-interconnection approach. Science and religion become objects that are integrated and interconnected. The philosophical foundation is in terms of ontology, epistemology, and axiology. Science and religion need to be combined because they are interrelated and complementary. One of the reasons for integration is the loss of religiosity in science, so there is a need for dialogue between them.

The concept of integrative-interconnective science seeks to combine religious scholarship, which is based on text, with general science, which is classified into two forms, namely natural science and social science. This effort produces output that has a philosophical balance, both in terms of scientific procedures and meaning. This concept embodies the principle of connectedness and interrelation between various scientific disciplines as a whole. The goal is to answer the multiple complexities of problems comprehensively parsed, identified, and resolved.²¹

The principles that need to be considered in the preparation of curriculum and syllabus and courses using the ethos and breath of reintegration of scientific epistemology, namely: *Hadarah an-Nash* (the cultural buffer of the Bayani text), is no longer used to stand alone, apart from *Hadarah al-Ilm* (engineering,

¹⁹ M. Amin Abdullah and M. Amin Abdullah, *Islamic Studies Dalam Paradigma Integrasi Interkoneksi: Sebuah Antologi* (Suka Press, 2007), vii.

²⁰ Mohd Amin Abdullah, *Islamic Studies Di Perguruan Tinggi: Pendekatan Integratif-Interkonektif* (Yogyakarta: Pustaka Pelajar, 2012).

²¹ Ainol Yaqin, "Integrasi Ilmu Agama Dan Sains (Kajian Atas Pemikiran Al-Ghazāli)," *Islamuna: Jurnal Studi Islam* 3, no. 1 (2016), 37-55.

communication) and also cannot be separated from Hadarah al-Falsafah (ethics) and vice versa. Hadarah al-'Ilm (culture of science), namely empirical sciences that produce science and technology, however, do not have "character," which side with human life and the environment, if not guided by Hadarah al-Falsafah (ethical culture-emancipatory). Meanwhile, Hadarah an-Nash (the religious culture that solely refers to the text) combined with Hadarah al-'Ilm (science and technology), without knowing the slightest contemporary humanities, is also dangerous not careful it will easily be carried away. Towards the radicalism-fundamentalism movement.²²

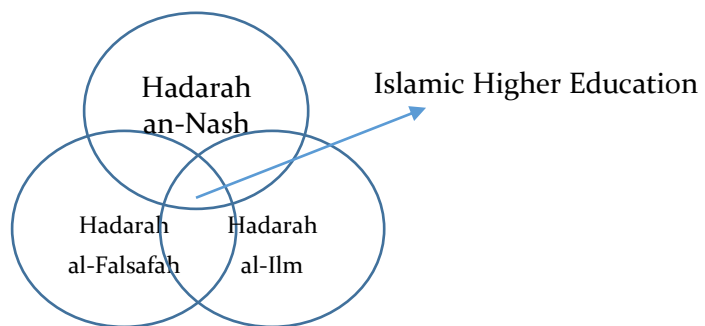


Figure 1. Schematic in building integration-interconnection science

Nine principles must be developed in welcoming higher education based on integration and interconnection, namely:

1. Integrate and develop science and Islam for the advancement of civilization
2. Strengthening the scientific integration-interconnection paradigm depicted in the scientific spider web
3. Building the integrity of faith, knowledge, and charity through integrated learning between Hadarah an-Nash, Hadarah al-Falasifah, and Hadarat al-'Ilm
4. Develop and instill an inclusive attitude in the learning process
5. Maintain sustainability and encourage change in scientific development
6. Building a partnership pattern between lecturers, students, and employees to create a peaceful and dynamic academic climate
7. Develop learning with an andragogical approach and active learning principles

²² Amin Abdullah, *Islamic Studies Di Perguruan Tinggi*, 402-403.

8. Developing the spirit of master learning in learning to achieve optimal competence
9. Organizing and developing an integrated management and information administration system based on fundamental Islamic values supported by information technology for excellent service.²³

The integration-interconnection concept is reflected in the spider web, which states that knowledge's interconnections are mutually transparent (integration-interconnection). There are three aspects of ethos and breath of reintegration of scientific epistemology, including Hadarah an-Nash (a cultural buffer for the Bayani text), Hadarah al-'Ilm (technique, communication), and Hadarah al-Falsafah (ethics). These three breaths are used as a reference for higher education's scientific field and a foothold in developing it.²⁴



Figure 2. Scientific Spider Web

As illustrated as a "spider web," the scientific paradigm building shows the scientific spider web's relationship: the anthropocentric-integralists-interconnective. It can be seen that al-Qur'an and al-Sunnah are the centers of scholarship. From this central science, ijihad patterns are developed using various approaches and methods. This process then provides inspiration for the

²³ Waryani Fajar Riyanto, *Integrasi-Interkoneksi Keilmuan: Biografi Intelektual M. Amin Abdullah (1953-...), Person, Knowledge, and Institution* (Yogyakarta: Suka Press, 2013).

²⁴ Eka Saftri and Ihsan Sa'dudin, "Aplikasi Integrasi Interkoneksi Keilmuan Di Lembaga Pendidikan Tinggi," *Tadrib* 5, no. 1 (2019), 122-137.

emergence of sciences in the next layer, namely the traditional Islamic sciences layer. In the same way, in the following periods, natural, social, and humanities sciences were born, which led to the emergence of contemporary sciences and issues at the next level.

The symbolic image of the "scientific spider web" also suggests a dotted line, resembling a pore attached to the various scientific disciplines' dividing wall. The porous boundary wall is interpreted not only in terms of the boundaries of scientific disciplines but also from the boundaries of time and space and habits of thought. These pores are like vents in the vent, which function as a regulator of air circulation in and out and exchange information between various scientific disciplines. Each of these disciplines, along with the culture of thought, the accompanying traditions, can freely communicate with each other, have dialogue, send messages, and input new findings in their respective fields to other disciplines outside their respective fields. There is an exchange of scientific information in a free, comfortable, and carefree atmosphere.²⁵

The integrative-interconnective paradigm offered by Amin Abdullah is the answer to the various problems above. Integration and interconnection between different scientific disciplines, both from secular science and religious scholarship, will make them interrelated, "greet each other," and complement each other's weaknesses and strengths. Thus, religion's science is no longer concerned only with classical texts but also touches on contemporary social sciences.²⁶

The epistemology design of religion and science in the integration-interconnection paradigm illustrates that religion and science have differences in perceiving truth. These differences are still used to construct a comprehensive understanding of the meaning and meaning of reality itself. Science seeks to explain phenomena that are material in nature and calculate them quantitatively to find the causes of the phenomena that occur. Meanwhile, religion tries to interpret the phenomena that occur as a result of something intangible.

The science integration-interconnection paradigm is a pattern of academic interaction that illustrates that each discipline cannot stand alone. Interdisciplinary scientific dialogue is a necessity because each scientific field is interrelated and complementary to one another. In this paper, the interconnections of science focus on a fundamental understanding of the two

²⁵ M. Amin Abdullah, "Religion, Science and Culture: An Integrated, Interconnected Paradigm of Science," *dalam Al-Jami'ah: Journal of Islamic Studies* 52, no. 1 (2014).

²⁶ Toto Suharto, "Pemetaan Ayat-Ayat al-Qur'an Tentang Rumpun Ilmu Agama Dalam Perspektif Paradigma Integrasi-Interkoneksi," *Intizar* 24, no. 1 (2018), 83-102.

major systems accepted as a measure of the discovery of truth, namely religion and science. Revelation and reason are epistemological tools that do not destroy and blame each other, but as a whole, that strengthens each other in giving birth to the real value of truth.

Examples of forms of scientific integration-interconnection in education, such as the learning process related to purification. Water in the purified chapter is generally divided into three, namely absolute water (holy and purifying water), *musta'mal* water (water that has been used), water *mutanajjis* (unclean water). In learning management about water, an educator is required not only to convey normatively about water, as in the science of *fiqh* alone. However, it must also be able to dialogue and relate it to scientific facts about water, its impact, and its function for life. Based on this, educators must have sufficient insight, reading, and literature to provide various information about purification. Water in scientific studies contains multiple crystalline forms of several types of water. The crystals formed from the water will be beautifully shaped and perfect if given a positive response, such as the words "thank you", "very good", "happiness", "love and gratitude". Conversely, if given a negative response such as, "you are stupid", "useless", "suffering", then water is tough to form crystals, even the form obtained is far from a crystal form.²⁷

Each Islamic higher education institution may mention the pattern of developing the connection of sciences in various ways. UIN Sunan Ampel pursues the integration of Islamic and general sciences with an integrated twin tower, which is the meeting point between two scientific buildings: the tower of religious sciences and the tower of available science and humanities. The meeting point is in the form of a bridge between the two of them manifested through epistemological construction. Visually, the meeting point is depicted as a curved line at the top of the two interconnected scientific towers. The link of the two scientific buildings gave birth to multidisciplinary Islamic knowledge such as sociology of religion, philosophy of religion, Islamic economics, Islamic politics, and others.

Meanwhile, UIN Sunan Kalijaga is developing the concept of an interdisciplinary approach through integration and interconnection. Then UIN Syekh Maulana Malik Ibrahim Malang with a multidisciplinary approach through the idea of the tree of knowledge. Likewise, UIN Syarif Hidayatullah develops

²⁷ Imam Machali, "Pendekatan Integrasi-Interkoneksi Dalam Kajian Manajemen Dan Kebijakan Pendidikan Islam," *el tarbawi* 8, no. 1 (2015), 32-53.

integration of expertise, and UIN Sunan Gunung Djati Bandung with a cartwheel or revelation guides knowledge.²⁸

Based on the study of the concept of scientific integration of the five UINs, it was found that the concept of scientific integration developed at the three UINs in Indonesia used a paradigmatic model framework of integrative scientific integration or Islamization of science, integratism or Islamic science, and dialogue. UIN Jakarta and UIN Surabaya developed the concept of scientific reintegration with a dialogical integration paradigm. UIN Yogyakarta uses the idea of scientific integration-interconnection with an intergalactic paradigm or Islamic science. UIN Malang and UIN Bandung developed the concept of universalistic scientific integration paradigmatic of Islamization of science.²⁹

Although the concepts or labels vary, they have the same content in looking at the relationship between the natural sciences, social sciences, and humanities, namely the desire to build relationships between the three fields of knowledge through synergy interrelation. Whatever concept or labeling is used, there is a longing to realize scientific disciplines that will greet each other and approach each other. Claims about strict segregation between the three fields are not impossible now and even more so in the future.

Technological Innovation in Integration and Interconnection in Islamic Higher Education

The rapid development of information and technology cannot be avoided and essential for education and learning. Educators are the core of education. Without teachers, education will not run effectively. Therefore, educators must be able to balance the learning system with technology that is increasingly developing. Educators must combine learning methods with technology to help students understand that education and technology must be compatible and able to create learning activities in any situation. Therefore, the learning revolution becomes a necessity. Learning innovation 4.0 emphasizes mastery of learning methods by educators, their application in learning, and their development.³⁰

The attitudes or skills that educators need to have in the face of the Industrial 4.0 era include:

²⁸ Darda, "Integrasi Ilmu Dan Agama."

²⁹ Umi Hanifah, "Islamisasi Ilmu Pengetahuan Kontemporer (Konsep Integrasi Keilmuan Di Universitas-Universitas Islam Indonesia)," *TADRIS: Jurnal Pendidikan Islam* 13, no. 2 (2018): 273–294.

³⁰ Nurhayani Siregar, Rafidatun Sahirah, and Arsikal Amsal Harahap, "Konsep Kampus Merdeka Belajar Di Era Revolusi Industri 4.0," *Fitrah: Journal of Islamic Education* 1, no. 1 (2020), 141–157.

1. Friendly with Technology. The world is always changing and developing to a higher level; one of the changes is marked by technological advances. Everyone will not be able to fight technological advances; therefore, educators should have the will to learn continuously to be crushed by them. Changes in the world by technological advances do not need to be a threat, but should be faced positively, learn, adapt, and are happy to share with colleagues or colleagues both success and failure.
2. Collaboration. Maximum results will be difficult to achieve if done individually without cooperation or collaborating with other people. Therefore, educators must have a strong will to collaborate and learn with and or from others. This attitude is needed now and in the future. Doing it is not too tricky because the world is interconnected, so there is no reason not to collaborate with others.
3. Creative and dare to take risks. Creativity is one of the skills needed in the 21st century, and creativity will produce a structure, approach, or method to solve problems and answer needs. Educators need to exemplify this creativity and work smarter to integrate this creativity into their daily tasks. Educators also need not be too afraid of making mistakes but are always ready to face the risks that arise. Mistakes are the first step in learning and don't need to be a hindering factor in moving forward.
4. Have a good sense of humor. Educators who are humorous are usually most often remembered by their students. Laughter and spirit can be essential skills to help build relationships and relax in life. This will reduce stress and frustration and allow other people to see life from a different perspective.³¹

The era of the industrial revolution 4.0 requires an education system that can form a creative, innovative, and competitive generation. This is by changing the method of learning in the existing education world. Besides, the development of a cyber system in the world of education will allow teachers to provide up-to-date teaching materials according to the times because they can directly display the classroom material online. In other words, the development or provision of cyber network facilities as part of the integration with information technology networks in educational institutions will create various facilities, both in academic and non-academic administration and teaching and learning processes, which lead to improving the quality of Human Resources output from an educational institution.

³¹ Delipiter Lase, "Pendidikan Di Era Revolusi Industri 4.0," *sundermann: Jurnal Ilmiah Teologi, Pendidikan, Sains, Humaniora dan Kebudayaan* 1, no. 1 (2019), 28-43.

Individual educational technologists must be able to adapt to the various changes in the demands of education 4.0 by existing and contributing positively to multiple modifications and optimizing their abilities by creating effective technology-based learning and learning resources as educational tools that are expected to be able to produce output that can compete in the industrial era 4.0. This is where educational technology role plays a significant part in facilitating the teaching and learning process in the education era 4.0.³²

The development of Science and Technology, which is increasingly advanced, makes the Revolution's demands continue to increase. The global community certainly needs to prepare provisions to face these changes. Of course, there are only two choices that can be taken, including the desire to change and meet the demands of the times or to remain silent and wait to be changed. Technology can be a friend or an enemy, depending on how we use it. With these technological advances, even causing a job to be replaced by a machine, and new jobs that require various fields of science appear.³³ The benefits of information and communication technology for education are access to online libraries, access to experts, online lectures, providing academic information services for an educational institution, providing data search engine facilities, providing discussion facilities, providing alumni directory facilities and institutions, and provide cooperation facilities.³⁴

Five critical elements must be implemented by the Directorate of Islamic Religious Higher Education to encourage PTKI's competitiveness in the global arena in the era of the Industrial Revolution 4.0, namely:

1. Preparation of a more innovative learning system in higher education such as adjusting the learning curriculum, and improving student abilities in terms of data Information Technology, Operational Technology, Internet of Things, and Big Data Analytics, integrating physical objects, digital and human to produce competitive and skilled university graduates, especially in the aspects of data literacy, technological literacy, and human literacy.
2. Reconstruction of higher education institutional policies adaptive and responsive to the 4.0 industrial revolution in developing the required transdisciplinary and study programs. The Cyber University program has also begun to be pursued, such as a distance learning system, thereby

³² Surani, "Studi Literatur."

³³ Yus Mochamad Cholily, Windy Tunas Putri, and Putri Ayu Kusgiarohmah, "Pembelajaran Di Era Revolusi Industri 4.0," in *Seminar & Conference Proceedings of UMT*, 2019.

³⁴ Ishak Abdulhak and Deni Darmawan, "Teknologi Pendidikan," *Bandung: PT. Remaja Rosdakarya* (2013).

reducing the intensity of lecturer and student meetings. Cyber University is expected to be a solution for the nation's children in remote areas to reach quality higher education.

3. Preparation of human resources, especially lecturers and researchers, and responsive, adaptive, and reliable engineers to face the 4.0 industrial revolution. Apart from that, rejuvenating infrastructure and infrastructure development for education, research, and innovation are also necessary to sustain education, research, and innovation.
4. Breakthroughs in research and development support the Industrial Revolution 4.0 and a research and development ecosystem to increase the quality and quantity of research and development in Higher Education, Research and Development Institutions, Industry, and Society.
5. Breakthrough innovation and strengthening innovation systems to increase industrial productivity and increase technology-based startups.³⁵

Information technology makes a tremendous contribution to the distribution of information materials to all parts of the world. Technology is a medium and is one instrument that is mass in nature and involves many people. Only by being in front of a computer or cellphone connected to the internet one can connect to the global virtual world to obtain or distribute information at one time. During the ongoing crisis in the world of Indonesian education, information technology is a bright spot that is expected to make a positive contribution to improving the quality of education. One of the products of integrating information technology into education is e-learning or electronic learning. E-learning is short for electronic learning, which utilizes technological media such as the internet, interactive TV, and audio videotapes to send learning materials anywhere and anytime.³⁶

E-learning is a system that is expected not only to replace conventional learning methods and materials but to add new innovative techniques and strategies in today's learning process. The application of e-learning is a new medium that can overcome student passivity, increase enthusiasm for learning, allow direct interaction, and learn independently.³⁷ The research states that students feel interested in e-learning, the application of e-learning makes it

³⁵ Harto, "Tantangan Dosen Ptki Di Era Industri 4.0."

³⁶ Puji Astuti, "Kemampuan Literasi Matematika Dan Kemampuan Berpikir Tingkat Tinggi," *PRISMA, Prosiding Seminar Nasional Matematika 1* (February 1, 2018), 263–268.

³⁷ Nana Nana and Endang Surahman, "Pengembangan Inovasi Pembelajaran Digital Menggunakan Model Blended POE2WE Di Era Revolusi Industri 4.0," in *Prosiding SNFA (Seminar Nasional Fisika Dan Aplikasinya)*, vol. 4, 2019, 82–90.

easier for students to learn, and the application of e-learning makes students become independent and have the courage to express their opinions.³⁸

E-learning can be used to integrate and interconnect science in higher education. Some of the e-learning used are campus e-learning, google classroom, moddle, WhatsApp Group, Telegram Group, and so on. Learning does not have to be in the school because it can use teleconferences, such as Google Meet, Microsoft Teams, Zoom, and Cisco Webex. Reading sources can be obtained from various kinds of literature such as national libraries, journal articles, both national and international, which can be accessed anytime and anywhere using the internet network. Most of the seminars currently held are virtual, which can be called webinars or zoominars that use the zoom platform or google Meet which is integrated with Youtube.

The Semester Class Plan is prepared based on the principle of combining Hadarah an-Nash, Hadarah al-'Ilm, Hadarah al-Falsafah without a dichotomy between the three. For example, the Islamic Education Philosophy subject needs to be developed based on Al-Quran and Hadith. An explanation is explained in terms of practical theory and its implications for social life. It is also necessary to use technology techniques so that the reason is easier to understand and more comprehensive. The hope is that students or students can obtain a complete scientific structure to become human beings who are guided by texts, do good with knowledge, and have a leading character for the community.

CONCLUSION

The development of science and technology is very rapid in this era. Humans must be able to use developing technology wisely not to be left behind and not fall into it. The knowledge that grows in society's view in the form of religious experience and general science should be no dichotomy between the sciences because the source is one, namely the Koran. Technological innovations that are developing so rapidly must be utilized to integrate and interconnect science to form the human beings needed by religion, homeland, and nation.

³⁸ Boy Indrayana and Ali Sadikin, "Penerapan E-Learning Di Era Revolusi Industri 4.0 Untuk Menekan Penyebaran Covid-19:(The Application of E-Learning in the Era of the Industrial Revolution 4.0 to Suppress the Spread of Covid-19)," *Indonesian Journal of Sport Science and Coaching* 2, no. 1 (2020), 46-55.

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