Strategy for Developing and Managing The Planetarium Based on The Unity of Sciences

Dr. H. Tolkah, M.A. Dr. Mohd Hafiz Safiai Muhammad Nurkhanif, M.S.I.



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FOREWORD

The sky has long been a canvas of wonder and curiosity for humankind. From ancient astronomers to modern scientists, the quest to understand the cosmos has inspired countless innovations and institutions—among them, the planetarium. This book emerges as a timely contribution to the discourse on astronomy education and management, particularly within the context of Islamic universities. It offers both a theoretical framework and practical insights for integrating the scientific exploration of the universe with a holistic educational mission rooted in the Unity of Sciences (UoS).

Structured into five comprehensive chapters, the book begins with an overview of planetarium management in Islamic academic institutions and a literature review that sets the stage for deeper inquiry. The second chapter builds foundational knowledge in astronomy, management theory, and the philosophical underpinnings of UoS, offering readers a rich and multidimensional understanding of the subject.

The third chapter takes us through an enlightening journey across Southeast Asia, highlighting notable planetariums in Malaysia and Thailand, before turning a focused lens on the Planetarium of UIN Walisongo. These comparative insights provide valuable benchmarks and contextual relevance for readers and stakeholders invested in regional developments. Of particular importance is Chapter IV, which outlines a forward-looking development strategy for the UIN Walisongo Planetarium. Anchored in the principles of UoS, the chapter presents organizational models, strategic initiatives, and management guidelines that align with global standards while respecting local values.

The concluding chapter brings together key findings and actionable recommendations, aiming to inform future policies and inspire innovation in educational astronomy. As such, this book not only contributes to academic literature but also serves as a practical guide for administrators, educators, and policymakers

We extend our deepest gratitude to the authors for their rigorous work and to all contributors who made the publication of this book possible. May it serve as a beacon for those aspiring to bridge science, education, and faith through the inspiring medium of the planetarium.

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INTRODUCTION

A. Overview of Planatarium Management in Islamic University

Planetarium is a place to expose celestial bodies as astronomy education to the public. In its development, the planetarium has an old concept and a modern high-tech concept. some planetarium designers Choosing the terminology for a new facility is another decision for planners to make, but regardless of the name chosen, the facility requires a mission statement. The mission statement outlines the purpose of the planetarium. These goals are often designed to be consistent with or complement the parent agency's mission statement (e.g. a museum or university where the planetarium is located). The purpose of the mission statement is a sustainable long-term goal.¹

Because every planetarium will serve a population with a particular nature, specific goals will vary among planetariums. Even before a planetarium building is designed and the instrument and other equipment are purchased, a directing person or group should clearly identify those specific goals².

¹ https://support.es.com/Software/Digistar6/Archive.aspx

² Schultz, S. K., & Slater, T. F. Who Are The Planetarians? A Demographic Survey Of Planetarium - Based Astronomy Educators. Journal of Astronomy & Earth Sciences Education (JAESE), 7(1), . (2020), 25–30. Retrieved from https://clutejournals.com/index.php/JAESE/ article/view/10355

A long-running dialogue exists in the planetarium profession about whether education or entertainment is the top priority of planetariums. This issue arises primarily for museum or science center facilities, since education is acknowledged as the primary goal in pre-college and university planetariums.³

In Indonesia, there are three planetariums (Planetarium Jakarta, Planetarium Surabaya, and Planetarium Tenggarong) which are can be used by students and the general public who want to know in general up to study astronomy. Planetarium is a container for the center of astronomical research activities through library media, documentaries, or direct observation. Planetarium will make an alternative for society to meet the needs of universal knowledge. The following is the position of the three planetariums scattered in Indonesia.

UIN Walisongo is the only higher education provider under the Ministry of Religious Affairs that teaches astronomy disciplines (Falak Studies, Islamic Astronomy, or Astro-Fiqh) from strata one (S.1) to doctoral level. Even the discipline of astronomy studies has become the distinction of UIN Walisongo from other Islamic religious universities in Indonesia. This is based on the historical roots of UIN Walisongo which has strong roots in the teaching and development of astronomy in Indonesia. The first Chancellor of IAIN Walisongo (1970) KH. Zubair Umar is an astronomer whose astronomy book has become a reference for the Ministry of Religion until now in terms of *Hisab Rukyat* in Indonesia.

³ J.E Bishop, Planetarium A Challenge for Educators; Role and The Value of The Planetarium, New York: The United Nations For International Space Year, 1992, 5

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As a concrete form in developing astronomy, UIN Walisongo Semarang has built a Planetarium and Observatory building. The construction of the Planetarium and Observatory building has the full support of the Islamic Development Bank (IsDB). The Planetarium and Observatory building is the largest and most sophisticated Planetarium and Observatory in the Higher Education environment in Indonesia and Southeast Asia.

The existence of the Planetarium and Observatory Building is not only a laboratory and scientific development for UIN Walisongo Semarang students but also function as an edutainment. Besides, the Planetarium and Observatory are also a museum and history of the development of Astronomy in Indonesia.

The planetarium, which was just completed in 2021, certainly has various challenges in terms of human resources, managerial, operational, maintenance, and management aspects so that the planetarium is able to play its role as a vehicle for edutourism and astronomy education for the general public. The management of the planetarium and observatory that is integrated with the Walisongo Science Techno Park can be used as an edutourism destination through simulations and documentation of observations of celestial bodies for the public. The international status attached to the planetarium of UIN Walisongo requires knowledge of international standard governance. Therefore, it is necessary to have international research that supports this to get a pattern and then be able to compare with the concept of unity of sciences.

B. Several literature Review of Planetarium

There are only a few comprehensive, scholarly literature reviews published in academic journals that cover the entire landscape of planetarium education research, and none within the last decade.

Brazell (2009) reviewed "Planetarium Instructional Efficacy: A research synthesis" for his doctoral dissertation at Texas A&M University. Of 46 total studies he located within the scope of the US and that were related closely to planetarium efficacy, only 19 satisfied his criteria to be included in a meta-analysis study. He considered the statistical effect sizes concerning student achievement and student attitudes, which highly constrained which studies he could use for analysis. Using standard practice, quantitative meta-analysis methods, Brazell's dissertation emphasized a selective group of planetarium education research articles related particularly to planetarium efficacy. Brazell found that "the planetarium has not been a very effective tool for improving student attitudes towards astronomy." However, the planetarium has been statistically effective, if not small in effect size for student achievement.4

Julia Diane Plummer (2014), Learning to Explain Astronomy Across Moving Frames of Reference: Exploring the role of classroom and planetarium-based instructional contexts. She said Learning astronomy involves significant spatial reasoning, such as learning to describe Earth-based phenomena and understanding space-based explanations for those phenome-

⁴ Brazell, B. D. (2009). Planetarium instructional efficacy: A research synthesis. Doctoral Dissertation, Texas A&M University.

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na as well as using the relevant size and scale information to interpret these frames of reference. This study examines daily celestial motion (DCM) as one case of how children learn to move between frames of reference in astronomy wherein one explains Earth-based descriptions of the Sun's, Moon's, and stars' apparent motion using the Earth's daily rotation. We analyzed interviews with 8-9-year-old students (N 1/4 99) who participated in one of four instructional conditions emphasizing: the space based perspective; the Earth-based perspective in the planetarium; constructing explanations for the Earth-based observations; and a combination of the planetarium plus constructing explanations in the classroom. We used an embodied cognition framework to analyze outcomes while also considering challenges learners face due to the high cognitive demands of spatial reasoning. Results support the hypothesis that instruction should engage students in learning both the Earth-based observations and space-based explanations, as focusing on a single frame of reference resulted in less sophisticated explanations; however, few students were able to construct a fully scientific explanation after instruction⁵.

Ka Chun Yu (2015) Using A Digital Planetarium For Teaching Seasons To Undergraduate. He said that Computer-generated simulations and visualizations in digital planetariums have the potential to bridge the comprehension gap in astronomy education. Concepts involving three-dimensional spatial relationships can be difficult for the layperson to understand,

⁵ Julia Diane Plummer, Alicia Kocareli & Cynthia Slagle (2014) Learning to Explain Astronomy Across Moving Frames of Reference: Exploring the role of classroom and planetarium-based instructional contexts, International Journal of Science Education, 36:7, 1083-1106, DOI: 10.1080/09500693.2013.843211

since much of the traditional teaching materials used in astronomy education remain two-dimensional in nature. We study the student performance after viewing visualizations in an immersive theater and in non-immersive classrooms for the topic of seasons in an introductory undergraduate astronomy course. Using weekly multiple-choice quizzes to gauge student learning, comparison of curriculum tests taken immediately after instruction and pre-instruction guizzes show a significant difference in the results of students who viewed visualizations in the planetarium versus their counterparts who viewed non-immersive content in their classrooms, and those in the control group that saw no visualizations whatsoever. These results suggest that the immersive visuals help by freeing up cognitive resources that can be devoted to learning, while visualizations shown in the classroom may be an intrinsically inferior experience for students.⁶

Sara K. Schultz (2020), Who Are The Planetarians? A Demographic Survey of Planetarium - Based Astronomy Educators. The research said, Over the last 100 years since the planetarium was invented and began to spread across the planet, discipline-based planetarium education researchers have worked diligently to catalog what concepts are taught in the planetarium and what audiences learn when attending a planetarium show. What is not clearly known is precisely 'who' it is that are teaching astronomy in planetarium. Numerous small-scale studies give hints about who plantarians are, but the existing participant demographics provided shed preci-

⁶ Yu, Ka Chun; Sahami, Kamran; Sahami, Victoria; Sessions, Larry C., Using A Digital Planetarium For Teaching Seasons To Undergraduate, Journal of Astronomy & Earth Sciences Education, v2 n1 p33-50 Jun 2015, https://eric.ed.gov/?id=EJ1101071

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ous little insight about them as broad field of professional experts. Knowing "who planetarians are" is critical to education researchers who need to know when they are studying planetarium educators who are more or less typical of most people in the field and when, instead, they are studying people who are unusual outliers and far less representative of the broader population. As a first step toward obtaining a glimpse of who planetarium educators are, a brief survey was broadly distributed through contemporary social media networks frequented by planetarium educators posing the question, "who are you?" The results from 61 respondents showed that 90% had undergraduate degrees, half of which were in physics or astronomy, and 38% hold graduate degrees. Additionally, only 8% have amateur astronomy or hobbyist backgrounds or any substantive K-12 classroom teaching experience. Perhaps unique to planetarium-based astronomy educators, 38% report having extensive backgrounds in theater and performance, These findings suggest that planetarium educators are a fundamentally different sort of individual than those who teach K-12 astronomy or do outreach as an amateur astronomer and, as such, perhaps have very different professional development requirements and expectations from those other astronomy-education related professional development consumers.7

⁷ Schultz, S. K., & Slater, T. F. (2020). Who Are The Planetarians? A Demographic Survey Of Planetarium - Based Astronomy Educators. Journal of Astronomy & Earth Sciences Education (JAESE), 7(1), 25–30. Retrieved from https://clutejournals.com/index.php/JAESE/article/ view/10355

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GENERAL CONCEPTS OF ASTRONOMY, PLANETARIUM, THEORY OF THE UNITY OF SCIENCES

A. Overview of Astronomy

1. Definition of Astronomy

Astronomy is a science that studies all forms of celestial phenomena and celestial orders that have no boundaries. From ancient times the science of astronomy has developed rapidly as a demand for the needs of human life in marking certain events. There are two terms that are often used by humans, namely astronomy and astrology (astrology). This term basically has a different meaning and placement and should not be mixed up in the context of its use. The word Astronomy is no stranger to hearing among people. Astronomy is a science in the field of science that has many uses for humans. Like calculating the weather per year, calculating when an eclipse will appear, or maybe calculating the distance from the earth's core to the sun. Previous astronomers have contributed a lot to the history of civilization, so that we can find many observatories and astronomical tools in various places.⁸

⁸ Riswanto, "Dasar-Dasar Astronomi dan Fisika Kebumian", Metro: November, 2014, 2

Astronomy comes from the Greek ($\alpha \sigma \tau \rho o \nu o \mu (\alpha = +, astronomia = astron + nomos)$ which is a branch of science from natural science or science that involves observing celestial objects or celestial objects such as stars, planets, comets, nebulae, star clusters. , or galaxies) as well as natural phenomena occurring outside the Earth's atmosphere. This science in general is the science of studying various aspects of celestial bodies such as their origin, physical/chemical properties, meteorology, and motion and also knowledge of these objects explaining the formation and development of the universe. Astronomy is one of the oldest sciences in the world. Some prehistoric cultures such as Egypt, ancient Greece, Babylonia, China, Indians, Iranians, and the Mayans have many relics of methods of observing the night sky.⁹

2. Development of Astronomy

The Development of Astronomy As the starting point for the development of astronomy, it was obtained from the Arabs, with the term An-Nujum science used to refer to astronomy and astrology. After that, astronomy developed into several scientific studies including: ¹⁰

Al-Falak (the science of celestial navigation that studies the shape of the celestial sphere, astronomy is currently more widely used in determining the Qibla direction)

Al-Hay'a (the study of the arrangement of celestial bodies). In Muslim societies, astrology continued to be practiced and

⁹ BB. Asmoro, E-Journal Universitas Atama Jaya Yogyakarta; Tinjauan Proyek Observatorium dan Museum Antariksa, (Yogyakarta: 2015) bab 2

¹⁰ Riswanto, "Dasar-Dasar Astronomi dan Fisika Kebumian", Metro: November, 2014, 4

to illustrate and encourage the development of astronomical knowledge.

Around the sixth century BC, ancient Greek thinkers had several scientific views regarding the solar system, including the first; The view that the earth is the center of the solar system, they are of the view that the earth is a celestial sphere that is stationary and is the center of this universe while the stars, moon and sun are attached to the celestial sphere and revolve around the sun. This is known as geocentric, which was stated among others by Aristotle (350 BC), and Ptolemy (140 BC). Second; This geocentric assumption was challenged by Aritachus (300 BC) who stated that the sun was the center of the universe. Only in eighteen centuries later in 1500, a Polish thinker Nicolaus Copernicus, put forward the theory that planets revolve around the sun and the earth is one of these planets, this view is called the heliocentric view.

After the successful creation of the telescope by Galileo Galilei, humans can open their eyes to be able to see the vast universe. So, in the end it was agreed that the sun is the center of our solar system. The creation of this telescope has had an extraordinary impact on the development of science in the field of astronomy. One of them is that it is found that the earth, apart from revolving around the sun (evolves) also rotates on its axis which is called rotation, because the earth's rotation and its round shape resembling an egg causes daily motion, namely the rising and setting motion of stars and other celestial bodies.¹¹

¹¹ Riswanto, "Dasar-Dasar Astronomi dan Fisika Kebumian", Metro: November, 2014, 5

If you explore further, you will find several scientific terms in studying celestial bodies, such as:

a. Cosmology

Cosmology is the study of the relationship of space and time to the universe, the type of relationship studied includes the origin and structure of space and time related to the universe. Cosmology explains the history of the universe on a large scale, specifically this science has to do with the evolutionary origin of an object. So Cosmology is the study of the shape, arrangement of the set, properties and expansion of celestial bodies. The principle says that the universe is the same at any time and in any place.¹²

b. Astrology

Astrology was originally included in the branch of science that studied celestial bodies, then it was connected with the aim of knowing one's fate or profit (unseen things). Astrology is an ancient prophecy which states that a person's personality is influenced by the position of the sun, moon, planets and stars at birth. Astrologers claim that the daily changes in the location of celestial bodies affect events in human life. This understanding originated over 200 years ago in Babylonian beliefs that worshiped the sky, and was later adopted by the ancient Egyptians and Greeks, all of whom believed that their gods were embodied in the form of moving celestial bodies. While people today are still many who use this understanding to predict events in their lives.¹³

¹² Dr. Watni Marpaung MA, "Pengantar Ilmu Falak", (Jakarta: 2015), 4

¹³ Michael A.Seeds, Horizon; Exploring The Universe, California: 1987,439

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c. Astrophysics

Astrophysics is a field of science that investigates celestial bodies, their temperatures, atmospheric mixtures, or who studies by means of laws, tools, and theories of physical laws. So, astrophysics is a part of astronomy, if astronomy discusses the position and movement of celestial bodies, then astrophysics uses the laws of physics to describe and explain the properties of these celestial bodies.¹⁴

3. Objects of Astronomical Studies

The object of astronomy study is all celestial objects that can be observed in the universe. Among the objects namely; planets, satellites, stars, nebulae, galaxies, asteroids, meteoroids, comets, black holes, etc. Here are some explanations of the objects of astronomical study, such as:

a. Planet

The word Planet comes from the Greek, "planetai" which means wanderer. A planet is a celestial body that orbits a star called the sun, with a certain trajectory and speed. According to KBBI, a planet is a celestial body that cannot emit heat, does not emit light, and has movement in the form of rotation and revolution that balances natural conditions. Scientists agree that a celestial body can be said to be a planet, if it meets the following 3 criteria:¹⁵:

 \bigcirc A planet in orbit around a star, but not a satellite,

¹⁴ Ahmad Musonnif, *Ilmu Falak; Metode Hisab Awal Waktu Shalat, Arah Kiblat, Hisab Urfi Dan Hisab Hakiki Awal Bulan*, Yogyakarta: 2011,2

¹⁵ Pribadi, Pandu, "Ilmu Dasar Astronomi", Jakarta: 2022, 87.

- \bigcirc Planets have sufficient mass so that they are almost spherical in shape,
- The planet has cleared the environment around its orbit ¹⁶.

Based on the location of their orbits, planets are divided into two groups depending on their boundaries. The first uses the Earth as a barrier and the second uses the asteroid belt as a barrier. Based on the earth as the boundary, the planets are divided into two groups, namely, inferior planets and superior planets:

- Inferior Planets Inferior planets are planets whose orbits are within the Earth's orbit. The inferior planets consist of Mercury and Venus.
- Superior Planet Superior planet is a planet whose orbit is outside the Earth's orbit. The superior planets consist of Mars, Jupiter, Saturn, Uranus, and Neptune.

Based on the asteroid belt as the boundary, planets are divided into two groups, namely, inner planets and outer planets:

- Inner Planets Inner planets are planets whose orbits are in the asteroid belt. The inner planets consist of Mercury, Venus, Earth, and Mars.
- Outer Planets Outer planets are planets whose orbits are outside the asteroid belt. The outer planets consist of Jupiter, Saturn, Uranus, and Neptune. Based on its composition, planet can be classified into two groups, namely terrestrial planet and Jovian one.

¹⁶ Ruben Cornelius, "Ilmu Dasar Astronomi", Banyumas: Agustus, 2022, 70

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- Terrestrial planet or earth planet (*planet kebumian*) constitutes a planet which has composition like an Earth, namely stones. Terrestrial planet consists of Mercurius, Venus, Earth, and Mars

b. Satellite

Satellite comes from the Latin word satelles, which means servant. Satellites are objects orbiting planets or other objects with certain periods of rotation and revolution. Natural satellites are non-man-made space objects that orbit a planet or other objects larger than themselves, such as the moon (Earth's natural satellite). Meanwhile, artificial satellites are man-made objects that circulate around other objects, for example the Palapa satellites that circle the earth. Artificial satellites are distinguished by their type and use, for example; communication satellites, science and technology satellites, and weather satellites¹⁸.

c. Stars

According to the Big Indonesian Dictionary (KBBI), stars are celestial bodies capable of emitting light and producing their own energy. According to the National Aeronautics and Space Administration (NASA), stars are the most widely recognized astronomical objects and represent the most basic building blocks and galaxies. Stars are also celestial bodies that are capable of producing light, heat, and can be seen from the night

¹⁷ Riswanto, "Dasar-Dasar Astronomi dan Fisika Kebumian", Metro: November, 2014, 49

¹⁸ Putri Saraswati, Mardlijah, "Analisis dan Kontrol Optimal Sistem Gerak Satelit Menggunakan Prinsip Minimum Pontryagin", JURNAL SAINS DAN SENI ITS, (Surakarta: 2017) Vol.6, No.2,45

sky. Stars are also referred to as balls of glowing gas. Most of the constituents are hydrogen and helium¹⁹.

The two materials are held together by gravity with a high temperature which then produces energy. Each star will have a different size and amount of energy. You can tell the energy in a star by looking at the color of its light. Stars with white or blue light have high temperatures. While the star with a lower temperature or cooler has an orange or red color. A group of stars that are close together and intertwined to form a special configuration is called a constellation, including the constellation Leo or Burj al-Asad, this constellation consists of 92 stars²⁰.

d. Nebula

Nebula comes from the Latin word nebulae or nebulæ which means fog, is an interstellar cloud consisting of dust, gas and plasma. Originally nebula was the general name given to all expansive astronomical objects, including galaxies outside the Milky Way (some examples of old usage survive; for example, the Andromeda Galaxy is sometimes referred to as the Andromeda Nebula)²¹.

e. Galaxy

The word galaxy comes from the Greek galaxias (γαλαξίας), which means «like milk,» which refers to the Milky Way galaxy (English: Milky Way). A galaxy is a massive, gravitationally bound system consisting of stars (with all their manifestations,

¹⁹ Pribadi, Pandu.88.

²⁰ Pribadi, Pandu, 89.

²¹ Riswanto, 78.

including neutron stars and black holes), interstellar medium gas and dust, and dark matter—an important but poorly understood component.²².

f. Asteroid

Asteroids are small and dense celestial bodies found in our solar system. Asteroids are an example of a type of small planet (or also called a planetoid), but much smaller than a planet. Asteroids are in a belt between Mars and Jupiter called the asteroid belt²³.

g. Meteorid

Meteoroids are small space rocks that float freely in space and move fast. The meteoroid's trajectory is irregular and does not orbit the Sun. Meteors are meteoroids that are attracted to the Earth's atmosphere due to the influence of Earth's gravity. Because they experience great friction by the atmosphere and their fast movement can reach the Earth's surface, meteoroids burn up in the atmosphere. This burning meteoroid is called a meteor. Earthlings see burning meteors as shooting stars. Meteorites are meteoroids that enter the Earth's atmosphere, experience friction in the atmosphere, and fall to the ground. From these meteorite findings, experts know that meteoroids consist of rock, iron, and nickel²⁴.

h. Comet

Comets are celestial bodies that are similar to asteroids, but are formed almost entirely of gas (carbon dioxide, methane,

²² Riswanto, 79.

²³ Ruben, Cornelius, 129.

²⁴ Ruben, Cornelius, 129.

water) and frozen dust. Comets have orbits or trajectories that are elliptical, more oval and longer than planetary orbits²⁵

4. Early Development of Astronomy

Before Islam, the knowledge of the Arabs about the stars was limited to dividing the year into the correct period on the basis of the ascension of the stars and their arrangement (anwa). The first translations of Arabic texts were in the languages of Indian and Persian texts. The original works of Arabic astronomy were produced during the transition period. ²⁶ The following is one of the works of the Arabs in astrology shown in Figure 2.1.



Figure 2.1 Works of Arab Astronomy

²⁵ Ruben, Cornelius, 131.

²⁶ Riswanto, "Dasar-Dasar Astronomi dan Fisika Kebumian", Metro: November, 2014, 5

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Al-Qonum and al-Mas'udi were famous astronomers, during the time of Al-Biruni (973-1048 AD) which was the culmination of the first stage in the development of Arabic astronomy. After the entry of Islam in the Arab culture, matters relating to astronomy were issues related to Islamic worship such as determining prayer times, sunrise and sunset times in relation to fasting, Qibla direction, visibility of the crescent moon (beginning of the month) and calendar calculations. . In addition, with the work in the form of astrolabe images, quadrants, square compasses and cartographic grids.

5. Local Wisdom of Astronomy and Constellations

Most Indonesian people are people with livelihoods as farmers. This causes them to know and study astronomy in connection with agriculture. Meanwhile, some other people who have other livelihoods will name the constellations according to their own imagination. Some forms of constellation imagination in the form of agricultural things such as Waluku (Orion), Kalapa Doyong (Scorpio), Cow Gumarang (Taurus), and Wuluh (Pleiades), etc. And in the form of cruises, for example, pari or crux huts (Crux) and big dipper latitudes. The imagination of each community will certainly be different, so each region will certainly have a different name. Below are presented several forms of Indonesian local wisdom, including²⁷:

In explaining the lunar eclipse that occurs when the full moon is known, there is a folklore, namely the Giant (Batara

²⁷ Riswanto, "Dasar-Dasar Astronomi dan Fisika Kebumian", Metro: November, 2014, 5

Kala) swallowing the moon, where each region in Indonesia certainly has a different version according to the regional culture.

The constellation Waluku (Orion), which is known by the Javanese people, resembles a Luku so that it appears at the start of the planting season, so this constellation is used as a marker for the arrival of the planting season and as a pointer to the west because it appears in the western part of the earth.

Kartika latitude (Pleides), Pari latitude (Crux) serves as a pointer to the cardinal directions and south direction, the Big Dipper constellation as a west direction and the Scorpion constellation as an east direction.

Apart from that, there is also a story told by one of my campus friends who come from eastern Indonesia, to be precise, the Bima and Sumbawa areas, regarding the appearance of a worm-like animal that glows at every full moon.

According to the beliefs of the ancient Javanese people, during the dry season this mist passes through the zenith, stretching from east to west, resembling a pair of legs straddling the Earth. This leg belongs to Bima, a member of the Pandawa family who is told in the Mahabharata puppet. So big was his body and how powerful he was, that the fog was called the Milky Way, a name that we still use to this day to name the fog, namely the Milky Way.

And there are also reliefs of the sun and stars at Borobudur. The pattern of the main stupa is a shadow which explains that Borobudur can be used to determine time.

Constellations or constellations are a collection of stars that appear connected and intertwined and then form a configuration with a special pattern. The arrangement of the constellations is not official, but it is widely known by the public but not recognized by astronomers or the International Astronomical Association, it is called asterism. This is because in rare constellations or asterisms that have an astrophysical relationship, they just happen to appear close together in the sky as seen from the earth and are usually very far apart. The International Astronomical Association has divided the sky into 88 official constellations with clear boundaries, so that each direction belongs to only one constellation. We can see the various constellations and the names according to the Egyptian catalog with the help of some software including stellarium software, castelestia software and Sky Map on Android.

In fact, we can see the pattern of stars and the Milky Way galaxy/milky way (Greek term) with our eyes without the aid of a telescope, but in bright and unpolluted atmospheric conditions the comparison can be seen in Figure 1.2. If we look at the clear sky which is spotless due to the influence of dust and CO2 air pollution, we will see the color of the sky and the stars in it. But now most of us, have lived under the air canopy and polluted air conditions. This urban air pollution makes it difficult for us to see the stars clearly. In the Northern Hemisphere, most of the constellations are based on Greek tradition, passed down through the Middle Ages, and contain the signs of the Zodiac.

B. Overview of the Planetarium

1. Definition of Planetarium

The planetarium building is a building that has a room with a dome-shaped ceiling and in the middle of the dome there is a star projector. These projectors project light points onto the dome ceiling to represent the night sky and can be used to indicate the positions of constellations, stars and planets. Since two centuries BC, attempts have been made to make tools that imitate the motion of celestial bodies, which also function at the same time to test the accuracy of the existing theory at that time. Then around the 17th century had known props called planetarium, stellarium, tellurium and lunarium. At the end of the 17th century, a spherical wall had been made whose inner surface was drawn with stars or given small holes for sunlight to pass as a depiction of the location of the stars²⁸.

The first ancient planetariums were props or miniature models of the solar system using mechanical machines, high work in the hands of watchmakers. The visual aids are indeed made to tell time, by making displays of moving celestial bodies that can be used as a reference for astronomical time. These simple methods then gave impetus to the emergence of innovative minds to create a light projection system on a spherical wall that continues to be used today. The visual aid in the form of a mechanical machine that can accurately describe the motion of the planets around the sun was last made in 1924²⁹.

²⁸ S.Darsa, Planetarium Dan Observatorium Jakarta, 2014, 9.

²⁹ S.Darsa, Planetarium Dan Observatorium Jakarta, 2014, 10.

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The idea of making props with a light projection system to produce a picture of the sky close to the real one was put forward by Max Wolf, a German astronomer. At that time, scientific progress in the field of optics, instrumentation and electricity made it possible to realize this idea. The Carl Zeiss company, which was founded in 1846 and is known for its reputation in manufacturing quality optical instrumentation, is the company that is trusted to make this light projection device. In May 1925 the projector was installed permanently in the German-Munich museum. The people who witnessed the first performance were amazed. This first planetarium was destroyed in World War II, but in the 1950s this planetarium was rebuilt³⁰.

Since the presence of the first projector, new projectors with various updates to present the sky and its contents in the domed room have continued to appear. With all its sophistication, now the planetarium is no longer just a tool to understand the movement of celestial bodies, but also to explain astronomy in general and broadly. Equipped with various supporting facilities and activities, the modern planetarium has now become a place for scientific tourism, recreation while being knowledgeable. Thus the planetarium was born from human hands to help humans understand the universe and understand their position in this vast universe. The Jakarta Planetarium, which is one of thousands of planetariums around the world, stands as a tool for Indonesian people who want to open their eyes to see the universe. The planetarium is an educational tourism facility that can add a very broad

³⁰ S.Darsa, Planetarium Dan Observatorium Jakarta, 2014,13

insight to visitors, especially in the field of astronomy because the planetarium show, which is often called the Bintang Theater, presents various kinds of natural events in the universe³¹.

In the Bintang Theater, visitors are invited to travel to various places in the vast universe so that visitors can understand the concept of the universe and at the same time understand the greatness of the Supreme Creator. In a digital planetarium, various types of new performances can be displayed in a multimedia format wrapped in the realm of astronomy. This type of show presents things related to the universe in which humans live. In addition to sky simulation shows or multimedia. Several planetariums also have facilities and infrastructure for observing celestial bodies to witness phenomena or other natural events. Planetarium is an alternative means of entertainment for the general public, this is indicated by making the planetarium an alternative place for family recreation. (S.Darsa : 1992 dalam Hendri : 2014 : 15)

In addition to acting as a vehicle for education, the planetarium also acts as a vehicle for recreation for parents to their children and their students (students). The planetarium is also included in the tourism program of each country, in order to help the country's foreign exchange, although its scope is still small. Sometimes the Planetarium is also used as an entertainment facility for orchestral music that has a simulated celestial object in the background. The planetarium acts as a scientific institution that is not only a place for professional astronomers to think and work, but also a place for the public to know and appreciate science. In modern economic termi-

³¹ S.Darsa, Planetarium Dan Observatorium Jakarta, 2014, 14.

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nology, Planetarium acts as a public good. In the course of his research, a Planetarium often gives birth to various kinds of new findings in the world of astronomy in particular, and in science in general³².

The purpose of building this planetarium building is to add added value to the development of the city of Makassar and also to become a place of knowledge for the general public who are unfamiliar with astronomy.

2. History of the Planetarium

The planetarium was originally a mechanical demonstration device to show the movements of heavenly bodies such as stars, planets, the moon and the sun. Until the 19th century, planetarium meant a mechanical display device called an orrery. The first planetarium projector was built in 1919 based on an idea by Walther Bauersfeld of Carl Zeiss. In August 1923, the first projector, named the Model I, was installed at Carl Zeiss' factory in Jena. Bauersfeld gave his first public demonstration with the projector at the Deutsches Museum, Munich, 21 October 1923. The Deutsches Museum became the world's first planetarium after the projector was permanently installed in May 1925. At the start of World War II, the projector was dismantled and hidden. After the Deutsches Museum, which was destroyed by World War II, was rebuilt, the Model I projector was re-installed on May 7, 1951. The planetarium building is generally managed by an educational institution or museum. All over the world there are more than 3,300 planetariums

³² S.Darsa, Planetarium Dan Observatorium Jakarta, 2014,15.

(as of March 4, 2008) with a total of more than 110 million viewers. Even so, the number of planetariums in the world is far greater if the school's mini planetariums are counted. The country with the most planetariums in the world is the United States. There are more than 1,500 planetariums in the United States. In Europe there are more than 450 planetariums³³.

3. Planetarium Function

a. Planetarium As Educational Vehicle

The planetarium is an educational tourism facility that can add a very broad insight to visitors, especially in the field of astronomy because the planetarium show, which is often called the Bintang Theatre, presents various kinds of natural events in the universe. In this theater, visitors are invited to travel to various places in the vast and amazing universe so that visitors can understand the concept of the universe and at the same time understand the greatness of the Supreme Creator. In a digital planetarium, various types of new performances can be presented in a multimedia format wrapped in the realm of astronomy. This type of show presents things related to the universe that humans live in. In addition to sky simulation shows or multimedia. Some planetariums also sometimes have facilities and infrastructure for observing celestial bodies to witness phenomena or other natural events³⁴. Planetarium as a Means of Entertainment

³³ S.Darsa, Planetarium Dan Observatorium Jakarta, 2014,10.

³⁴ S.Darsa, Planetarium Dan Observatorium Jakarta, 2014,13.

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Planetarium is an alternative means of entertainment for the general public, this is indicated by making the planetarium an alternative place for family recreation. Apart from acting as a vehicle for education, the planetarium also serves as a vehicle for recreation for parents to their children and their students (students). The planetarium is also included in every country's tourism program, in order to help the country's foreign exchange, although the scope is still small. Sometimes the Planetarium is also used as a means of entertainment for orchestral music which has a simulated view of celestial objects as the background³⁵.

b. Planetarium As A Place Of Research And Observation

The planetarium acts as a scientific institution that is not only a place for professional astronomers to think and work, but also a place for the public to know and appreciate science. In modern economic terminology, Planetarium acts as a public good. In the course of his research, a Planetarium often gives birth to various kinds of new findings in the world of astronomy in particular, and in science in general³⁶.

4. Devices and Elements in the Planetarium

As a means of edutainment in astronomy, a planetarium certainly has supporting infrastructure. The equipment is a hemispherical domed building, inside which is used as a star theater that plays a three-dimensional simulation of the sky,

³⁵ S.Darsa, Planetarium Dan Observatorium Jakarta, 2014,13.

³⁶ S.Darsa, Planetarium Dan Observatorium Jakarta, 2014, 13.

with the dome ceiling as a projection medium from a special projector capable of depicting the positions of celestial bodies at night or during the day. In addition to the sky panoramic theater, a modern planetarium currently has various facilities. Such as exhibition halls, interactive rides, and so forth.

5. Planetarium Facilities

Ideally, the planetarium has a main facility as well as supporting facilities. The facilities include³⁷;

a. Show Room

This space is the main facility that attracts every visitor. This planetarium holds show events for groups of school students and the general public, covering basic issues of earth and space knowledge that are adapted to the school curriculum. Topics that are conveyed include; Recognition of celestial bodies at night, Daily motion of celestial bodies, Changes in the phases of the moon, Solar and lunar eclipses, Earth as a planet, Sun, Solar system, Flight into space, Stars, Milky Way galaxy and other galaxies.

b. Exhibition Hall

Materials or collections contained in the planetarium are presented in the form of photographs and miniature models of celestial objects that can explain the shape and dimensions of real objects. The circulation used is circular circulation

³⁷ S.Darsa, Planetarium Dan Observatorium Jakarta, 2014,15-17.

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c. Show Room

This Dual Image of Space is useful for conveying information in audio-visual form in the form of documentary films, the image is projected on a flat layer, with this media knowledge can be presented in an interesting and compact way, so that the benefits are very useful to help the learning and teaching process.

d. Hall And Waiting Room

The hall is divided into two, namely the waiting room as a hall and the waiting room as a star theatre, ticket purchase queue room and showroom. Both of these rooms are relatively large rooms, because most of the visitors are groups.

e. Library

The library is open to the public, in order to provide opportunities for visitors who want to expand their knowledge of astronomy.

6. Planetarium Classification

a. Planetarium classification based on service function:

 Special Planetarium is a planetarium that is only used for educational or research purposes only. For example in public schools, universities and military training schools (air force and navy)³⁸.

³⁸ A. Sari, Planetarium Medan Arsitektur Metafora. Jurusan Arsitektur, Fakultas Teknik. Universitas Sumatera Utara. Medan, 2010

2) Public planetarium is a planetarium open to the general public, the purpose of which is to educate and entertain both informatively and expressively. Usually the shows and programs are more interesting and the supporting facilities are more complete. This type of planetarium can be further distinguished into: - Formal planetarium, which is a planetarium that has its own management even though it is joined with other facilities but the relationship is mutually supportive. - Complementary planetarium, is part of a science center or museum that functions to attract visitors.

b. Classification of planetariums based on dome size³⁹:

- Small size planetarium is a planetarium that has a dome size with a diameter of between 5m-12m. With an estimated audience of around 30-100 people.
- A medium-sized planetarium has a dome size between 12m-18m in diameter with an estimated audience of around 100-200 people.
- Large planetariums have a dome diameter of more than 18m. Where with an estimated audience of around 3001000 people.

³⁹ Deasy, Pesoth, Perancangan Planetarium di Manado Analogi sebagai Strategi Desain. Program Studi S1 Arsitektur. Jurusan Arsitektur. Fakultas Teknik. Universitas Sam Ratulangi Manado, 2011.
C. Overview of Management theory

1. Definition of Management

According to Mary Parker Follet the notion of management as a process, because in management there are activities that must be carried out, for example planning, organizing, directing and supervising activities. These activities cannot be separated from each other or in other words are interrelated (integrated), so that they will form an inseparable unity. If we associate it with an observatory, the activities mentioned above must exist and can be carried out properly. Therefore, management is referred to as System. Management contains the following elements⁴⁰:

- a. Management as a process / effort / activity
- b. Management as an art
- c. Management consists of individuals / people people who carry out activities
- d. Management uses various sources and factors of production available in an effective and efficient manner
- e. There are goals that have been set in advance.

According to James F. Stoner the notion of management is the process of planning, organizing and using resources and other sources in order to achieve organizational goals that have been set. Thus, management aims at a process of coordinating and integrating work activities completed efficiently and effectively through other people. The process of describing management functions goes according to their respective duties and responsibilities. Even though they differ in perspective,

⁴⁰ Muhammad Qarid dkk, Book Chapter; Astronomi Islam, Medan: UMSU Press, 2021, 19

the concept of management still refers to planning, organizing, directing, and controlling⁴¹.

The definition of management comes from the word manage, in the Big Indonesian Dictionary it means to lead, control, regulate, and make efforts to make it better, more advanced, and responsible for certain jobs. Management is a process that helps formulate policies and objectives providing oversight of all matters involved in the implementation and achievement of objectives⁴².

Management can be interpreted as management, which is a process of activities that starts from planning, organizing, directing and monitoring the efforts of members of the organization and the use of other organizational resources in order to achieve predetermined organizational goals.

According to Terry, interpreting the management function as an effort to achieve predetermined goals through the efforts of other people. Management cannot be separated from human resource activities in an office, agency, or organization. A good manager always works with functional management steps, namely planning, organizing, directing, and controlling⁴³.

2. Management Objectives

a. Management as a process of activity

As an activity process, management is defined as a series of activities starting from planning, implementing and coordi-

⁴¹ Muhammad Qarid dkk, Book Chapter; Astronomi Islam, Medan: UMSU Press, 2021, 19

⁴² George R Terry, Prinsip-Prinsip Manajemen, Jakarta: Bumi Aksara, 2012, 15

⁴³ George R Terry, Prinsip-Prinsip Manajemen, Jakarta: Bumi Aksara, 2012, 16

nating what is planned to monitoring or controlling activities so that they are in accordance with what is planned.

b. Management as a science and an art

Management as a science and art is defined as an effort to achieve goals by approaching and explaining management phenomena and symptoms as well as transforming and identifying management processes based on scientific principles.

c. Management as a collection of people to achieve goals

Any activity carried out by two or more people cooperatively in an organization is referred to as a management activity. The collectivity of these people joins in an organization and is led by a leader (manager) who is fully responsible for efforts to achieve goals efficiently and effectively.

3. Management Functions

Ricky W. Griffin defines management as a process of planning, organizing, coordinating, and controlling resources to achieve goals (goals) effectively and efficiently. Effective means that the goals can be achieved in accordance with the plan, while efficient means that the existing tasks are carried out correctly, organized and according to schedule⁴⁴;

a. Planning Function

In management, planning is the process of defining organizational goals, creating strategies to achieve those goals, and

⁴⁴ John Sheldrake, Management Theory Second Edition, Sidoarjo: Zifatama Publisher, 39

developing plans for organizational work activities. Planning is the most important process of all management functions because without planning the other functions of organizing, directing and controlling will not be able to run.

b. Organizing Function

The process concerning how the strategies and tactics that have been formulated in the planning are designed in an appropriate and robust organizational structure, conducive organizational system and environment, and can ensure that all parties in the organization can work effectively and efficiently to achieve organizational goals.

c. Directing and Implementation Functions

The process of implementing the program so that it can be carried out by all parties in the organization as well as the process of motivating so that all parties can carry out their responsibilities with full awareness and high productivity.

d. Supervision and Control Function

The process is carried out to ensure that the entire series of activities that have been planned, organized and implemented can run according to the expected targets even though various changes occur in the environment the business world is facing. Management Functions and Processes In general, management is divided into several functions, namely planning, coordinating, supervising and controlling activities in the context of efforts to achieve the desired goals efficiently and effectively. Henry Fayol proposes that all managers carry out at least five management functions, namely designing, organizing, commanding, coordinating, and controlling⁴⁵.

- a. Planning. Planning can be defined as a process to determine the goals and objectives to be achieved and take strategic steps to achieve these goals. Through planning a manager will be able to know what to do and how to do it.
- b. Organizing. Organizing is the process of giving orders, allocating resources and organizing activities in a coordinated manner to individuals and groups to implement plans. The activities involved in organizing include three activities, namely (1) dividing the components of activities needed to achieve goals and objectives in groups, (2) assigning tasks to managers and subordinates to carry out the grouping, (3) assigning authority among groups or organizational units.
- c. Directing. Directing is a process to foster motivation in employees so that they can work hard and diligently and guide them in carrying out plans to achieve goals effectively and efficiently. Through direction, a manager creates commitment, encouraging efforts that support the achievement of goals.
- d. Control. The last part of the management process is controlling. Control is intended to see whether the organization's activities are in accordance with the previous plan. The control function includes four activities, namely (1) determining achievement

⁴⁵ John Sheldrake, Management Theory Second Edition, Sidoarjo: Zifatama Publisher, 41

standards; (2) measuring the achievements that have been achieved so far; (3) compare the achievements that have been achieved with the standard of achievement; and (4) make improvements if there are deviations from the established achievement standards. Management Function Analysis After analyzing the management functions of the experts, the authors argue that the management functions consist of planning (planning), organizing (organizing), motivating (providing motivation) and controlling (controlling).

Meanwhile, management is needed in an organization, because without management or management all efforts will be in vain and achieving goals will be more difficult. There are several management objectives, including:

- a. To achieve organizational goals based on the vision and mission.
- b. To maintain a balance between conflicting goals. Management is needed to maintain a balance between the conflicting goals, objectives and activities of interested parties in an organization.
- c. To achieve efficiency and effectiveness. An organization's work can be measured in many different ways, one common way is efficiency and effectiveness.

D. Overview of Unity of Sciences (UoS)

1. The Unity of Sciences (UoS) Paradigm

Among observers of the philosophy of science, the word paradigm, which was first popularized by Thomas Samuel Kuhn (1922-1996), has become very important. 20 For Kuhn, a paradigm is a set of theories, methods, and scientific guidelines agreed upon by allied scientists that will differentiate them from other (non-cognate) scientists. Through his monumental work, The structure of Scientific Revolutions (1962), he emphasized the importance of considering history for the analvsis of the philosophy of science.⁴⁶ Through this work, Kuhn criticized earlier views on the development of science. In the traditional view, the development of science is evolutionary and gradual accumulation of scientific discoveries that have ever existed. Meanwhile, according to Kuhn, the development of science is revolutionary, gestalt-switch, gestalt-shift.23 Karl Popper, for example, is of the view that scientific development takes place empirically by first proposing a hypothesis and then being tested (falsified)47.

The process takes place gradually, continuously, and accumulatively from previous discoveries. The accumulation process also takes place in an evolutionary manner and is not influenced by social factors in the scientific community⁴⁸. Kuhn revised Popper's opinion. For Kuhn, the development

⁴⁶ Harold I. Bernard Cohen, *Revolution in Science* (Cambridge-Landon: The Belknap Press of Harvard University Press, 1985, 566

⁴⁷ Thomas Kuhn, The Structure of Scientific Revolutions London: The University of Chicago Press. Ltd., 1970) 122

⁴⁸ Thomas Kuhn, The Structure of Scientific Revolutions London: The University of Chicago Press. Ltd., 1970) 123

of science is not determined by empirical-logical falsification, but is determined by the social conventions of the scientific community. In its development, the old agreement was replaced by a new agreement. The change of agreement was revolutionary, not evolutionary. That is, the old agreement is replaced by a completely new agreement. Because it is completely new, the new agreement will not be understood if we depart from the old one. The content of the agreement by Kuhn is called a paradigm.

In explaining his idea of the scientific revolution, Kuhn uses several key terms that he never defined strictly in The Structure. The key terms are scientific revolution, paradigm, paradigm shift, normal science, anomaly, and crisis. In Kuhn's thinking, the development of science starts from the pre-paradigmatic stage, which is an era in which human knowledge does not yet have a set of theories, methods, and other scientific guidelines which Kuhn calls a paradigm⁴⁹. This era is approx. of primitive society. They have not used certain grips in solving their problems which are the result of the creativity of their predecessors. All problems are solved as is, without a set of theories and methods.

Along with the change of generations, finally emerged theories, methods, facts, experiments that were mutually agreed upon and became the guideline for the scientific activities of scientists. This is what Kuhn calls a paradigm⁵⁰. Paradigm according to Kuhn also helps the scientific community to define

⁴⁹ Thomas Kuhn, *The Structure of Scientific Revolutions* London: The University of Chicago Press. Ltd., 1970), 17-18

⁵⁰ Thomas Kuhn, *The Structure of Scientific Revolutions* London: The University of Chicago Press. Ltd., 1970), 11

its discipline and create discoveries, formulate problems, choose appropriate methods in answering problems, determine areas of study, etc⁵¹. So, paradigms are essential for scientific inquiry.

The process of the emergence of a paradigm through a process of competition between various theories that have emerged. Only the best theory will be accepted as a paradigm by the scientific community. However, history proves that there is no perfect paradigm in solving scientific problems. Therefore, research will continue to be needed⁵². And a paradigm will form a certain scientific community.

The paradigm of the unity of science is actually a scientific paradigm typical of Muslims which states that all knowledge is basically a unity that originates from and leads to Allah through His revelations, either directly or indirectly. Therefore, all knowledge should have dialogue with each other and lead to one goal, namely to bring the reviewer to know and get closer to Allah as al-Alim (The All-Knowing).

To clarify the description of the paradigm of unity of sciences at UIN Walisongo, look at the following diagram:

⁵¹ Thomas Kuhn, The Structure of Scientific Revolutions London: The University of Chicago Press. Ltd., 1970), 16-17

⁵² Harold I. Brown, Perception, Theory, and Commitment: The New Philosophy of Science (Chicago and Londonn: The University of Chicago Press, 1977), 9-11.



In the picture above the middle roundabout is Wahyu, while the outermost roundabout is nature. While the other 5 roundabouts are religious sciences and humanities, social sciences, natural sciences, mathematics and computer science, as well as professional and applied sciences. The picture above necessitates the unity of knowledge in the sense that all knowledge must come from revelation, either directly or indirectly, and must also be in the realm of nature, all of which originate from God. Unity of sciences can be described as a form of a federal state like the USA (United States of America). Details of any knowledge are welcome to develop as a state in the USA. However, all the states are still united by certain things like foreign policy and taxes. Such is the unity of sciences. Whatever the branch of knowledge, it is still bound in one unit, namely both directly and indirectly sourced from revelation and nature. Revelation and nature, if you want to extort it, are actually an acknowledgment of Allah (tawhid). The diagram above is also different from the paradigm of separation of sciences that has been developed by the West which, when illustrated, becomes as follows:



The separation of sciences image above shows that each group of sciences is far from each other. The roundabout in the middle shows the revelations that the reviewers were unable to address to the other 5 clusters of knowledge. Besides that, between one and the other of the five knowledge clusters also do not greet each other.

The unity of sciences developed by UIN/IAIN Walisongo is also different from the unity of science initiated by Neurath. If illustrated Neurath's view would be as follows⁵³:



In the picture above, the two circles are an illustration of two groups of knowledge, namely natural sciences and social and humanity sciences. The wider circle is an image of the natural sciences while the narrower one is an image of the social and humanity sciences. Neurath is of the view that social and hu-

⁵³ Laporan Kegiatan Workshop Penyusunan Kurikulum Berbasis Unity of Sciences IAIN Walisongo Tahun 2013, 3

man sciences should use one standard language and method, namely the standard language and methods developed by the natural sciences. Thus, the two groups of knowledge can be united by the same scientific language and the same methodological standards.

2. UoS Principles

The principles in developing the paradigm of the unity of sciences are as follows⁵⁴:

a. Integration.

This principle believes that the construction of all sciences as an interconnected unit, all of which originate from the verses of Allah, both those obtained through the prophets, intellectual exploration, and natural exploration.

b. Collaboration.

This principle combines the universal values of Islam with modern science in order to improve the quality of life and human civilization.

c. Dialectics.

This principle necessitates an intense dialogue between sciences rooted in revelation (revealed sciences), modern science (modern sciences), and local wisdom (local wisdom)

⁵⁴ Laporan Kegiatan Workshop Penyusunan Kurikulum Berbasis Unity of Sciences IAIN Walisongo Tahun 2013, 227

d. Prospective.

This principle believes that the paradigm of the unity of knowledge will produce new sciences that are more humane and ethical which are beneficial for the development of the dignity and quality of the nation and for the preservation of nature.

e. Pluralistic.

This principle believes in the existence of a plurality of realities, methods and approaches in all scientific activities.

3. UoS Approaches

Apart from having principles, the wahdatul ulum paradigm also has an approach. The approach in question is theo-anthropocentric. This approach guides researchers to always make God the origin and goal of all scientific processes without leaving the role of humans as creatures with scientific credentials⁵⁵.

4. UoS strategy

In terms of strategy for implementing the unity of sciences paradigm, UIN Walisongo has three strategies, namely: (1). Humanization of Islamic sciences. (2). Spiritualization of modern sciences. (3). Revitalization of local wisdom⁵⁶.

⁵⁵ Laporan Kegiatan Workshop Penyusunan Kurikulum Berbasis Unity of Sciences IAIN Walisongo Tahun 2013, 228

⁵⁶ Laporan Kegiatan Workshop Penyusunan Kurikulum Berbasis Unity of Sciences IAIN Walisongo Tahun 2013, 229

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PLANETARIUM IN SOUTHEAST ASIA

A. Al-Khwarizmi Astronomy Complex Melake Malaysia

1. Background

Al-Khwarizmi Astronomy Complex is a place to study and explore the mystery of Universe and the complex is situated in Kampung Balik Batu and along the Melaka. It's the effort of the Melaka State Government to generate public awareness of the important of astronomy, as well as support the growth of astronomy via tourism activities. This complex is named after an astronomer called Abdullah Muhammad Ibn Musa, a.k.a Al-Khwarizmi.

The Al-Khwarizmi Falak Complex is a astronomy/astronomy complex developed by the Kingdom of the State of Melaka located in Balik Batu Village, Tanjung Bidara, Tanah Mosque. This complex is the largest celestial complex in Malaysia with an area of 1.62 hectares containing a Cerap Hall, Planetarium and Training Center which provides accommodation facilities, lecture booths, auditorium, seminar board, exhibition gallery, exhibition board, terrace hall and ceiling dome.

This complex is placed under the supervision of the Melaka State Mufti Position which has been built in phases since 2002. There are 3 phases of development with the first phase being the construction of Balai Cerap in 2002 and followed by the second phase in 2005, namely the construction of the Planetarium. The last phase was the construction of the Training Center and Lodging in 2007.



This complex was established to dignify the science of astronomy in society through the ease of learning and tourism activities. There are council facilities for seminars, courses and meetings that can be carried out and accommodation facilities are also provided. Astronomy education travel activities such as interactive gallery tours, planetarium and 3D science documentaries, moonlight visions and night sky views.

a. Falak Al-Khwarizmi Complex Sdn. Bhd (KFAKSB)

Which is a fully owned subsidiary of the Melaka Islamic Religious Council (MAIM) was established on June 16, 2008 and is responsible for managing the Falak Al-Khwarizmi Complex on December 1, 2008. KFAKSB plays a role in running commerce by offering conveniences and activities. activities in the Falak Al-Khwarizmi Complex to the public. In addition, KFAKSB has a role in revitalizing astronomy through education to its customers with astronomy activities offered with the support and cooperation of the Melaka State Mufti. This effort can promote the spread of astronomy into society through travel activities. Customers will be given basic knowledge about astronomy and feel the greatness of the majesty of the Creator's creation.

b. Vision and Mission of the Falak Al-Khwarizmi Complex

The vision of the Falak Al-Khwarizmi Complex is to become the foremost center of astronomical tourism in Malaysia. To achieve this vision, the Falak Al-Khwarizmi Complex has three pillars (1) excellent customer service, (2) efficient financial management, (3) providing the best facilities.

The mission of the Falak Al-Khwarizmi Complex is to provide efficient and customer friendly service. The general mission is then broken down objectively as follows:

- 1) Responsible for achieving revenue targets as set.
- 2) Trying to provide the best service to customers.

- 3) Promote the spread of astronomy into society through travel activities.
- Provide basic knowledge about astronomy and give experience to feel the greatness of the creation of the Supreme Creator.
- 5) Organizational Structure of the Falak Al-Khwarizmi Complex

The Falak Al-Khwarizmi Complex has the following organizational structure:



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c. Flow and schedule of visits

To achieve the vision and mission, the Falak Al-Khwarizmi Complex has the following visit schedule:

Training Center & Lodging

Waktu Urusan					
HARI	MASA	REHAT			
Isnin - Sabtu	8.00 am - 1.00 pm	1.00 pm - 2.00 pm			
	2.00 pm - 5.00 pm				
Ahad	8.00 am - 1.00 pm	-			

Absorption Hall & Planetarium

Waktu Operasi & Jualan Tiket				
HARI	MASA	REHAT		
Isnin - Khamis	9.00 am - 12.30 pm	12.30 pm - 1.30 pm		
& Sabtu	1.30 pm - 4.30 pm			
Jumaat	9.00 am - 12.00 pm	12.00 pm - 2.30 pm		
	2.30 pm - 4.30 pm			
Ahad	Tutup			

2. Components of the Falak Al-Khwarizmi Complex

Falak Al-Khawarizmi Complex, Kampung Balik Batu, Tanjung Bidara, Melaka. It consists of 3 phases starting from the establishment of the Cerap Center (2002), Al-Khawarizmi Planetarium (2005) and the Training Center (2010). Falak and astronomy development efforts by the State Kingdom of Melaka.

a. Observatory

This observatory was built in the first location to see the crescent moon in the state of Malacca. This location is located on the west coast of the state of Melaka, namely in Kampung Balik Batu, Tanjung Bidara, Melaka. Built in 2002 Started operating in 2003. Location overlooking the crescent moon in Melaka. The Al Khawarizmi observatory has a permanent telescope pillar as a telescope mounting stand that is used for the moment of crescent observation for portable telescopes and also theodolites. In addition, there is also a core telescope in the dome of the Al Khawarizmi observatory.



Pear/permanent mount of Alkhawarizmi Observatory



al Khawarizmi observatory's main telescope inside the dome of the observatory

b. Al Khawarizmi Planetarium

Al Khawarizmi Planetarium is the First Digital Planetarium in Malacca that provides 3D and planetarium shows. This planetarium can accommodate as many as 90 visitors at a time. Built in 2005 Started operating in 2006 The first digital planetarium in Melaka. The planetarium has an exhibition gallery. This gallery contains 4 exhibition concepts which are solar system exhibition, astronomy exhibition, space exploration zone and night sky zone.

Each of these exhibitions provides input to visitors related to astronomy and astronomy. The planetarium in the Al Khawarizmi complex, in addition to having technological sophistication, also has adequate facilities and infrastructure, such as a large parking lot, a training area, accommodation for training participants, and also a food court/cafe.



Accommodation building and al Khawarizmi training building



Falak Traditional Equipment Gallery

There are traditional falak tools on display in this gallery. Equipment such as astrolabe, rubu'mujayyab, istiwa stick, sundial and others.



Al Khawarizmi Complex interactive gallery

This gallery was inaugurated by YAB the Chief Minister of Melaka in 2020. This gallery is the result of collaboration between the Melaka State Mufti Department and the Technical University of Malaysia Melaka (UTEM)



Prototype astronomy planetarium Al Khawarizmi



Al Khawarizmi Planetarium system operator place



Al Khawarizmi planetarium show room and projector

c. Al Khawarizmi Planetarium Show Schedule

Al Khawarizmi Planetarium serves the show according to the schedule that has been determined. The show schedule is at 10.30 a.m., 11.30 a.m., 2.30 p.m. and 3.30 p.m.



List of Al Khawarizmi planetarium films

d. Training Centre

Built in 2006, this training center has auditorium facilities, lecture rooms, multi-purpose hall, dining hall and accommodation center. This training center is used for visitors who wish to deepen their theoretical and practical knowledge in the field of astronomy. The target of this training is students from elementary to university level. Below is a list of training packages and seminar packages held at the Al Khawarizmi complex.

Pakej Kursus/Mesyuarat (Umum)			
40pax	60pax		
Penginapan	Penginapan		

Harga - RM 90.00 seorang/sehari
▶ Sajian 6x
Dewan Seminar
▶ 30 unit Semi Dorm

Pakej Kursus/Mesyuarat (Pelajar)			
40pax	80pax		
Penginapan	Penginapan		
▶ 40 unit Dormitri	▶ 80 unit Dormitri		
Dewan Seminar	Dewan Seminar		
▶ Sajian 6x	▶ Sajian 6x		
Harga - RM 65.00 seorang/ sehari	Harga - RM 65.00 seorang/sehari		

Pakej Seminar/Mesyuarat 1 Hari			
40pax	80pax		
Dewan Seminar	Dewan Seminar		
 Sajian 3x (Minum pagi, makan tengahari & minum petang) 	Sajian 3x (Minum pagi, makan tengahari & minum petang)		
Harga - RM 30.00 seorang/ sehari	Harga - RM 33.00 seorang/sehari		
120pax	300рах		
120pax • Auditorium	300pax • Auditorium		
120pax Auditorium Sajian 3x (Minum pagi, makan tengahari & minum petang)	300pax • Auditorium • Sajian 3x (Minum pagi, makan tengahari & minum petang)		

Pakej Seminar ½ Hari			
120pax	300pax		
Auditorium	► Auditorium		
 Sajian 2x (Minum pagi & makan tengahari) 	Sajian 2x (Minum pagi & makan tengahari)		
Harga - RM 26.00 seorang/ sehari	Harga - RM 19.00 seorang/sehari		
Pakej Lawatan Ilmiah Falak (Pelajar)			
40pax	80pax		
Penginapan	▶ Penginapan		
▶ 40 unit Dormitri	▶ 80 unit Dormitri		
 Sajian 3x (Makan malam, Sarapan pagi, Minum pagi/ malam) 	 Sajian 3x (Makan malam, Sarapan pagi, Minum pagi/ malam) 		
Harga - RM 50.00 - RM 55.00 seorang/sehari	Harga - RM 48.00 - RM 50.00 seorang/sehari		

Falak activities at Falak Al Khawarizmi complex include; Gallery tours, Planetarium and 3D Screenings, Sun Observation, Night Sky Observation, and Treasure Hunt Astronomy Quiz.

B. National Planetarium Kuala lumpur Malaysia

1. History and Background

The National Planetarium is an informal educational institution in the field of astronomy and space science located on 14 acres of land within the Perdana Botanical Gardens, Kuala Lumpur. Its unique architecture is characteristic of Islamic architecture and inspired by the achievements of astronomy and space science during the heyday of Islamic civilization.

The National Planetarium was established under the Prime Minister's Department in 1989. The construction of the National Planetarium complex began in 1990 and was fully completed and opened in May 1993. On February 7, 1994, the National Planetarium complex was inaugurated by YAB Dato' Seri Dr. Mahathir Mohamad, the Prime Minister of Malaysia at that time.

The complex houses a blue domed screen theater equipped with star projectors and large format movies. This dome is 20 meters in diameter and can accommodate 200 people at a time. The construction of the dome requires high precision and accuracy and is equipped with an audio visual system capable of simulating the movement of celestial objects



View of the gate in the Negare Kuala Lumpur planetarium

The National Planetarium Complex has been built with a design inspired by Islamic architecture with muqarnas characteristics. It is adapted from a geometric composition capable of reflecting and scattering light and functions as an effective sound absorption and reflection element. The architecture of the National Planetarium complex decorated with 110 steps leading to the blue dome symbolizes the evolution of the development and exploration of space science. It is equipped with a flow of water down the middle along the steps which symbolizes human life is so harmonious with space.

Despite the uniqueness of its design and the complexity of its construction, the National Planetarium has experienced a revolution in its service delivery system in line with today's technological developments. The National Planetarium has played its role in promoting the field of astronomy and space science to the public since it was inaugurated and now, its age has reached 25 years (1994 - 2019). With the theme 'Engraved in the Stars', the 25th Silver Jubilee Celebration Ceremony of the National Planetarium was held on 25 April 2019 at the Istana Hotel, Kuala Lumpur as a token of appreciation to its citizens who have ensured that the National Planetarium contributes and has an impact on the field of astronomy and space science in Malaysia . The Silver Jubilee Celebration Ceremony was officiated by YAB Dato' Seri Dr. Wan Azizah Dr. Wan Ismail, Deputy Prime Minister of Malaysia. YAB has also launched a book entitled "25 Years of the National Planetarium" which has been published to sketch the history of the success of the National Planetarium to the community in the field of space science.



The writer at the gate in the Negare planetarium

2. Vision and Mission of Planetarium Negare

- a. Vision Planetarium Negare; to be the best non-formal education and space science culture center in Malaysia.
- b. National Planetarium Mission; providing quality infrastructure and services to the community related to astronomy and space science activities

3. Functions of the National Planetarium

 a. Empowering the role of the National Planetarium as a Science, Technology, Engineering and Mathematics (STEM) cultural organization, especially in the field of astronomy and space science in Malaysia;

- Increase public awareness of the importance of astronomy and space science through screenings, exhibitions, programs and social media;
- c. Providing skills in the operation of optical astronomy digital projection instrumentation and amateur radio; and
- d. Provide advisory, coordination and guidance services for the development of human capital in the field of astronomy and space science in Malaysia.Struktur Organisasi

In order to achieve the vision and mission of an organization, Planetarium Negare has the following organizational structure:

			HZ Z	
KEMENTIERI	CARITA PLANEI AN SAINS, TI	ORGANISASI TARIUM NEGARA EKNOLOGI DAN INOVAS	și (MOSTI)	K
SEKSYEN PERCIDIDAWN		PENGARAH		
PEMBUDAYAAN PENCERAPAN	PAMERAN	SEKSYEN KHIDMAT PENGURUS	AN PERHUBUNGAN AWAM	J
Nitz: Bl. Projendan : 40	TERNIKAL	FASILITI KEWANGAN IT	KUTUBKHANAH	

Organizational structure of Planetarium Negare

4. Hours of Operation

Planetarium Negare Open from Tuesday to Sunday, 9.00am to 4.30pm and closed every Monday and selected public holidays such as Hari Raya Aidilfitri, Hari Raya Aidiladha, Federal Territories Day, Labor Day, National Day, Malaysia Day and Official Birthday Di-Pertuan Agong.

TEMPAT	DEWASA		KANAK-KANAK		PELAJAR	
	(13 TAHUN DAN KE ATAS)		(2 SEHINGGA 12 TAHUN)		(18 TAHUN DAN KE BAWAH) ROMBONGAN 30 ORANG	
	Bukan Warganegara	MyKID	Bukan Warganegara	MyKID	Bukan Warganegara	MyKID
TAYANGAN Planetarium	RM 12.00	RM 6.00	RM 8.00	RM 4.00	RM 8.00	RM 4.00
KEMBARA SIMULASI SPACE POD	RM 24.00	RM 12.00	RM 16.00	RM 8.00		
GALERI PAMERAN	PERCUMA					

5. Payment Rates

Planetarium Negare Entrance Tarif

6. The number of officers and staff of Planetarium Negare



7. Planetarium Negare Activities

As a center for space studies, the Negare planetarium has several activities to support its vision and mission, among others:



8. National Planetarium Target Program



C. Narit Planetarium Chiang May Thailand

1. History and Background

Thailand has a long history of interest in astronomy, particularly fostered through the Thai Royal Family. The National Astronomical Research Institute of Thailand began formal operation in 2008 as the national coordinating body for the development of astronomy and related space science in Thailand. The Thai government acknowledge the important role the subject can play in its efforts to move to a Knowledge-Based Economy that can compete with neighbouring nations such as Japan, Korea, Malaysia and Singapore in terms of science and technology and associated industries.

National Astronomical Research Institute of Thailand (Public Organization) (NARIT) is a research institute under the Ministry of Science and Technology (MOST) Thailand. It carries out an ambitious programme on playing a leading role in promoting and organizing cooperation in astronomical research throughout Thailand and South-East Asia.

NARIT is assigned to operate Thailand's most powerful ground-based astronomical telescope enabling important research in astronomy and astrophysics. The site is under construction at Doi Inthanon, a 2450 m high mountain 100 km south of Chiangmai. NARIT also undertake various public outreach programmes to promote astronomy education and awareness in Thailand.

NARIT therefore works very closely with the Thai Government and all the universities in Thailand that have an interest and expertise in astronomy to develop the subject nationally and internationally at several levels. There are around a dozen such universities in the country. Academic staff at NARIT also teach at Chiang Mai University – the city of Chiang Mai being where NARIT headquarters is situated in the new 'AstroPark'.

In addition to the main National Observatory at Doi Inthanon, NARIT has been committed to establish 5 more regional observatories scattered through the five geographical zones of the country. These observatories, though modest in scale comparing to the main National Observatory, will allow the public in the areas and nearby districts to gain better access to information in astronomy and space technology. Consequently, this will strengthen the infrastructure of the nation?s capacity in astronomy and space technology and will contribute to capacity building in education and even research in the field in the long run. It is speculated that through these regional observatories, collaboration and cooperation between the well established in big cities and the rural ones will substantialize.



Princess Sirindhorn Astronomical Park is the headquarters of the National Astronomical Research Institute of Thailand (NARIT). Located in the northern province of Chiang Mai, the park is a place for the latest research and development of space technology, academic services, and astronomy education. It is the largest and the most modern space science center in Thailand, and includes a planetarium, observatory, and a multi-purpose outdoor educational venue. It is an essential academic and tourist destination of Thailand and Southeast Asia.

2. Vision of NARIT

To be a world-renowned organization in Astronomy, Technology and Innovation.

3. Functions of NARIT

- a. To carry out research and development on astronomy and astrophysics.
- b. To establish a network and cooperate with organizations and research institutes, both domestic and international.
- c. To support and co-ordinate astronomical collaboration projects with other relevant institutes and organizations, on both national and international scale.
- d. To disseminate knowledge and technology development in astronomy.



Organization Structure of NARIT

4. NARIT'S Facilities

NARIT memiliki peran penting dalam upaya pengembangan astronomi di Tahiland. Sebagai pusat studi astronomi NARIT mempunyai beberapa fasilitas seperti:

a. Observatory



b. Planetarium



c. Astronomy Exhibition



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d. Learning and Research Center



5. NARIT planetarium System

In 2017 Fulldome.pro was chosen to build a 17 m diameter planetarium, which was the 5th and most significant project completed by our team for NARIT so far. Narit's Planatarium was engineered and installed a 360-degree and took digital planetarium with 160 seat capacity, 12 laser projectors, and 5K actual dome image resolution. Fulldome.pro project management team handled the construction process, which included installation and integration of equipment with the interior design, ensuring that all safety and operation requirements for public places are met. In addition, a team of subcontractors was hired to complete interior design and HVAC installation in the planetarium room. To fulfill all the requirements of this exciting project,Fulldome.pro engineering team once again came up with some innovative solutions.

Watching a bright screen in a dark room can strain the eyes. Bias lighting uses soft light behind or around a screen to reduce the apparent brightness and thereby reduce fatigue. This has been known since the early days of television. In the early 2000's Philips introduced its Ambillight (AKA Ambilux) technology with dynamic bias lighting that extended the colors on the screen beyond the bezel of the television. This not only reduced viewer fatigue but also increased immersion.

Fulldome.pro is the first to bring this idea to the dome screen. After several months of R&D and an upgrade of our media server software, NARIT has now extended the already immersive dome screen further by adding dynamic bias lighting to the walls of the planetarium. The edges of the every projected are analyzed for color, saturation and brightness, in real-time, and sent to the LEDs around the outer perimeter of the dome.

In this project, 1,560 individually addressable RGB LEDs were installed around the 52-meter circumference of the screen. Negative-pressure fabric screen technology, pioneered by Fulldome.pro, means that dome screens can be installed or upgraded quickly and more economically than rigid screens. They also make high-quality portable domes possible. However, large negative pressure screens, particularly in extreme climates can change shape and position slightly due to wide fluctuations in outside temperature and air pressure. The vacuum fans that hold the negative-pressure screen in place usually operate at a constant speed, but if the atmospheric pressure outside or inside the dome changes the relative pressure can change causing the screen to move from the position it was in when it was calibrated. The movement may only be very small but it may occur several times a day requiring frequent calibration and inconvenience.

To overcome this, our engineering team installed a special sensor to regulate the fan speed and maintain constant pressure in the screen envelope. This technology helps to eliminate screen movement and the need for recalibration, saving staff time, keeping the planetarium operating and visitors educated and entertained throughout the day.

By pairing the Fulldome.pro Media Server with carefully selected projectors we have been able to produce a dome picture of the highest quality. Once again, every frame is analyzed and the brightness of the projectors adjusted, in real-time, to achieve maximum contrast. The dynamic brightness adjustments are synchronized across all twelve projectors. As an added bonus, because the projectors are not always operating at maximum brightness, the lifespan of the laser light-source is extended from 20,000 hours to around 30,000 hours.

In addition, the NARIT planetarium is a treat for the ears too called the Dolby Atmos sound system. Eleven channels of spatial sound, including speakers behind the screen create a 3D effect and a subwoofer beneath the seats means the audience can feel the sound. Speakers are attached to the dome rig with our specially designed anti-vibration fixtures, to create a perfect resonance – because every little detail matters. All these technological innovations, and high-quality planetarium equipment, make a huge difference in visual and auditory perception, providing total immersion for astronomical and educational content.

D. Planetarium UIN Walisongo

1. History of UIN Walisongo Planetarium

Astronomy developed so rapidly during the golden age of Islam (8-15 AD). Islamic astronomical works are mostly written in Arabic and developed by scientists in the Middle East, North Africa, Spain and Central Asia. Astronomy in Islam, which we usually call Astronomy, is a very important science, because it is not only about activities related to worldly life, but also about the provisions for the implementation of worship, both obligatory and sunnah worship. For example, in determining the time of prayer, the Hijri calendar dating system to the Qibla direction.

In the world of Education, facilities and technology are as important as the curriculum. No matter how good the curriculum is, without the support of facilities and technology it will not be able to achieve maximum results. Astronomy is a kauniyah science whose main foundation is the study of nature. Therefore, facilities and technology to support research are absolutely necessary. In relation to the science of astronomy or astronomy, the existence of an observatory is something absolute.



Indonesia has 8 (eight) planetariums spread over several islands, including: Taman Ismail Marzuki, skyworrld Indonesia at TMII, UIN Walisongo, Taman Pintar Yogyakarta, PTNI Museum Al Museum Loka Jala Crana Surabaya, Imahnoong Kampung eduwisata Areng Lembang, UIN Mataram, and Planetarium Jagad Raya Tenggarong. UIN Walisongo's planetarium is the only one that is under the auspices of state higher education.

Currently, there is only 1 (one) planetarium in Central Java, namely in Taman Pintar Yogyakarta. Moreover, there is no planetarium that specializes in itself as a Unity of Science Planetarium that combines modern science with Islamic knowledge. Therefore, the construction of Walisongo Planetarium as a planetarium under the auspices of UIN Walisongo Semarang State College of Religion plays an important role as a center for research, education, and the development of Astronomy in Indonesia.

UIN Walisongo Semarang is the only State Islamic Religious University (PTKIN) that declares its distinction as a center for the development of astronomy studies in Indonesia. UIN Walisongo's planetarium is the third largest in the world. The center line of the dome in this building is 18 meters. UIN Walisongo got the support of the planetarium project from IsDB. Prof. Dr. Imam Taufik, M.Ag as the rector of UIN Walisongo for the period 2019-2023 explained that the development assistance for this project came from the government's offer when the IAIN campus changed its status to UIN.

One of the reasons why the study of astronomy is distinguished is that the development of astronomy has long and very strong historical roots at IAIN (UIN) Walisongo. It is clear that the first Rector of IAIN Walisongo (Year 1972) was a National astronomer even recognized at the Global level. He is KH. Zubair Umar Al-Jailany. He compiled the book Falak entitled: Al-Khulashah al-Wafiyyah. The calculation method in the Book of Falak is famously accurate until later the calculation results of the book Al-Khulashah al-Wafiyyah became the accounting standard of the Indonesian Ministry of Religion to determine the beginning of the kamariah month in Indonesia until now.

For that reason, UIN Walisongo Semarang organizes an Astronomy program from the Master's level (S.1). Magister (s.2) and Doctor (S.3). not only that, the success of UIN Walisongo in developing the study of astronomy is also supported by efforts to prepare in the field of infrastructure, facilities and infrastructure that are complete and modern, namely the astronomy laboratory.

Currently, UIN Walisongo astronomy laboratory is the most complete astronomy laboratory. The astronomy laboratory at UIN Walisongo consists of an observatory and a planetarium. Right now there have been many PTKINs who set up observatories. However, PTKIN that has Planteraium is only UIN Walisongo Semarang. No other PTKIN has it.

2. Vision and Mission

To move forward and define the future of the organization, UIN Walisongo Semarang Planetarium and observatory put together a vision and mission that realizes the dreams and attention of UIN Walisongo Semarang Planetarium and observatory. The vision of UIN Walisongo Semarang Planetarium and observatory is:

"Study and Research Development Center as well as a leading educational vehicle in Astronomy / Astronomy Based on the Union of Knowledge for Humanity and Civilization in 2038"

To realize that vision, the Planetarium and observatory of UIN Walisongo Semarang breaks it down into the following missions:Menjadi Pusat Pengembangan Studi Falak/Astronomi Islam di Asia Tenggara

- a. Become an Astro Education Icon at UIN Walisongo Semarang
- b. Become a Falak Training Center
- c. Become a quality facilitator in serving visitors,
- d. Become a professional facilitator in providing astronomy education services to teachers, students, undergraduates, researchers and the general public

3. Location and accessibility of UIN Walisongo Planetarium

The planetarium is located on Jalan Prof. Dr. Hamka, Tambakaji, Dist. Ngaliyan, Kota Semarang, Central Java to be exact at campus 3 UIN Walisongo. Geographically, the planetarium is at 110'20'53'BT and 6'59'31' LS.

As for accessibility to the UIN Walisongo planetarium, you can follow the following route:

a. From Poncol Station

Follow Jl. Imam Bonjol and Jl. Pemuda to Jl. Mgr Sugiyopranoto in Sekayu heading northeast towards Jl. Imam Bonjol. Turn left onto Jl. Imam Bonjol. Turn sharp right onto Jl. Youth. Use any lane to turn slightly left to stay on Jl. Pemuda. Pass Nasmoco Pemuda on the left. Keep turning right on Jl.Pemuda. Take Jl. General Sudirman and Jl. Siliwangi to Jl. Raya Semarang - Boja in Purwoyoso. At the roundabout, take the 3rd exit towards Jl. Mgr Sugiyopranoto. Pass Starbucks Museum Mandala (on the left). Continue to Jl. General Sudirman. Pass Sari Murni Siliwangi (on the left in 1.0 km). Stay in the right column. Merge onto Jl. Pantura Semarang - Kendal/Jl. Raya Pantura/Jl. Siliwangi. Follow Jl. Siliwangi. Pass Alfamart (on the left). Go straight and live on Jl. Siliwangi, Turn left onto Jl. Raya Semarang – Boja, At UPTD Pendidikan Ngaliyan District, proceed to Jl. Prof. Dr. Hamka.

b. From Ahmad Yani Airport

Take Jl. Puri Anjasmoro to Jl. Raya Pantura/Jl. Repeat. Martadinata/Jl. Yos Sudarso in Semarang towards the northwest. At the roundabout, take the 3rd exit. Continue straight to Jl. Anjasmoro Castle. At the roundabout, take the 3rd exit and stay on Jl. Anjasmoro Castle. At the roundabout, take the 2nd exit towards Jl. Anjasmoro Raya/Jl. Anjasmoro Castle. Continue on Jl. Raya Pantura/Jl. Repeat. Martadinata/Jl. Yos Sudarso. Driving from Jl. Siliwangi and Jl. Prof. Dr. Hamka to Purwoyoso. Turn right onto Jl. Raya Pantura/Jl. Repeat. Martadinata/Jl. Yos Sudarso. Use the 2 right lanes to turn slightly right. Merge onto Jl. Pantura Semarang - Kendal/Jl. Raya Pantura/Jl. Siliwangi. Follow Jl. Siliwangi. Pass Alfamart (on the left). Go straight and live on Jl. Siliwangi. Pass Jami' Nurul Islam Mosque (on the left 850 m). Turn left onto Jl. Raya Semarang – Boja. At UPTD Pendidikan Ngaliyan District, proceed to Jl. Prof. Dr. Hamka.

c. From Mangkang Terminal

Take a southeast direction towards Jl. Gen. Urip Sumoharjo/ Jl. Pantura Semarang - Kendal/Jl. Raya Mangkang/Jl. Raya Pantura/Jl. Raya Semarang - Batang. Follow Jl. Pantura Semarang - Kendal/Jl. Raya Pantura/Jl. Raya Semarang - Batang to Jl. Raya Semarang - Boja in Semarang. Take Jl. Prof. Dr. Hamka.

4. System, facilities, and infrastructure of UIN Walisongo Planetarium

In terms of equipment, UIN Walisongo Semarang's Planetarium and Observatory is equipped with adequate facilities and infrastructure, such as computers, laptops, LCDs, televisions, digital cameras, handycams, internet, furniture, cupboards and other supporting devices. As for the facilities and infrastructure as well as equipment facilities available at the UIN Walisongo planetarium, among others:

- a. Digital Projector for Planetarium (Digistar 6 from Evan & Sutherland USA)
- b. Integrated 5.1 Sound System (from Evan & Sutherland USA)
- c. Cove Lighting System (RGB Advance Level System from Evan & Sutherland USA)
- d. Fulldome Screen with premium premium seam technology
- e. The diameter of the dome shows hall is 18m long
- f. Audience seats with a capacity of 190 seats



Below we display some of the equipment owned by the UIN Walisongo Planetarium and Observatory of UIN Walisongo;

Projectors

	2D DP Dual Insight (2) (4096 x 2160)
Projectors	2
Lumens Per Projector	27,000
Native Contrast Ratio	2,000:1
Resolution Per Projector	4096x2160
Pixels Computed	17.7 MP
Pixels on the Dome	10.6 MP
Light Source Type	DLP
Lamp Type	Laser Phosphor
Light Source Life (hours)	20,000 to 50%



System Deliverables

DELIVERABLE	DETAIL
Digistar 6 Image Generator System	 One Dell Host Computer 2TB SSD Dell Graphics Computer(s) Dual 8 core Intel Xeon processor 32GB RAM a Graphics card SX DVD ROM 2TB HDD One 24" monitor (at the rack) Keyboard and mouse (at the rack)
Digistar 6 Software	 Full-featured digital planetarium with extensive library of models Optional: Digital Universe by American Museum of Natural History ES Video Fulldome Production Software Real-time 3D computer graphics Fulldome video playback Virtual slide and video projectors Ability to create own shows Desktop Streaming
	rsee product description for options
Operator Console	 Two 24" flat screen high-resolution LCD displays One backlit keyboard and mouse One wireless hand-held control (iPad Mini with Retina display) One joystick One Xbox controller
Integrated 5.1 Sound System Output	Connects into your audio system or an optional audio system you buy from us

DELIVERABLE	DETAIL
System Installation	Included
Projection Systems	2D DP Dual Insight (2) (4096 x 2160)

Digistar 6 Image Generator System

Consist of:

- One Dell Host Computer
 2TBSSD
- Dell Graphics Computer(s)
 - Dual 8 core Intel Xeon processor
 - ▶ 326B RAM
 - Graphics card
 - ▶ 8X DVD ROM
 - ▶ Two 2TB HDD
- One 24" monitor (at the rack)
- Keyboard & Mouse (at the rack)



Operator Console

Consist of:

- Two 24" flat screen highresolution LCD dispiays
- One backlit keyboard and mouse
- One wireless hand-held control (iPad Mini with Retina display)



One Xbox
 Controller



RGB Advance Level System

- A three-year warranty on all parts a components, noton ont e 1 ures.
- Fixtures are designed to offer ultimate heat dissipation and protection of components. No plastic lens is needed so chromatic aberration/shift/rainbowing is not an issue
- LED technology requires a very small number of power locations which minimizes power requirements and greatly reduces heat generation and maintenance
- Systems provide integrated and synchronized operation with Digistar systems. The LED lighting can receive a wide variety of commands from the Digistar host or wireless tablet controller
- Control and selection of scenes is accomplished either via the Digistar Control Panel, Digistar scripts, or the included desktop lighting controller with 15" touchscreen



Audio 5.1 Surround

- Control interface from Digistar for audio preset recall for various level adjustments in narration and subwoofer balance
- L-R-Center-Subwoofer-Ls-Rs 5.1 surround-sound speaker system and amplifiers
- Accepts Digistar 5.1 inputs
- Stereo audio from an Operator's Console mixer for mics, CD and other audio sources
- Professional Blu-ray/DVD/CD/MP3 player
- ▶ A hardwired handheld mic. cabling and mic stand with a mic input at the Operator's
- ▶ iPod or Auxiliary stereo audio input at console
- ▶ Programmable digital audio processor system
- Remote controlled AC Power Controller/Conditioners
- ▶ The front of the console rack is lit with red/white LEDs

- ▶ Professimal equipment room rack withshelves. etc.
- ▶ A console audio rack System with a Slant-top mixer rack and straight under desk front rack for CD and auxiliary devices
- Vibration isolated speaker suspension kits
- specifkany designed rnounting to dome
- System tuning with calbrated pink noise to deliver minimum 9S to the audience plus additional headroom



In addition, the facilities and infrastructure and equipment facilities available at the UIN Walisongo observatory include:

- a. Star telescope (main telescope)
- b. Solar and crescent telescope
- c. Digital detector
- d. 4 Portable telescopes and 2 types of mounting
- e. Supporting device: SQM LU DL, total stations

5. Hours of Operation

Monday s.d. Thursday

- ⇒ 08.30 10.00
- ∋ 10.30 12.00
- ∋ 13.00 14.30

Friday

- ⇒ 08.30 10.00
- ∋ 13.00 14.30

Saturday

∂ 09.00 – 13.00 (Special for individual/family visits)

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UIN WALISONGO PLANETARIUM DEVELOPMENT STRATEGY ON AN INTERNATIONAL SCALE BASED ON UoS

UIN Walisongo is the only higher education provider under the Ministry of Religious Affairs that teaches astronomy disciplines (Falak Studies, Islamic Astronomy, or Astro-Fiqh) from strata one (S.1) to doctoral level. Even the discipline of astronomy studies has become the distinction of UIN Walisongo from other Islamic religious universities in Indonesia. This is based on the historical roots of UIN Walisongo which has strong roots in the teaching and development of astronomy in Indonesia. The first Chancellor of IAIN Walisongo (1970) KH. Zubair Umar is an astronomer whose astronomy book has become a reference for the Ministry of Religion until now in terms of *Hisab Rukyat* in Indonesia.

As a concrete form in developing astronomy, UIN Walisongo Semarang has built a Planetarium and Observatory building. The construction of the Planetarium and Observatory building has the full support of the Islamic Development Bank (IsDB). The Planetarium and Observatory building is the largest and most sophisticated Planetarium and Observatory in the Higher Education environment in Indonesia and Southeast Asia. The existence of the Planetarium and Observatory Building is not only a laboratory and scientific development for UIN Walisongo Semarang students but also function as an edutainment. Besides, the Planetarium and Observatory are also a museum and history of the development of Astronomy in Indonesia.

A. Organization Structure

The planetarium and observatory of UIN Walisongo Semarang is an organization with modern management. The management developed is not top- down, with policy decisions coming from the highest level leadership. This organization adheres to collegial collective management, where policies are based on joint decisions made by all members involved. So, management is not based on one figure alone. The organization of the Planetarium and observatory of UIN Walisongo Semarang is structured with an emphasis on function and cooperation among members. Planetarium and observatory projects at UIN Walisongo Semarang are delegated to one division, but all policies are discussed together by all members. The combination of quality members and a loose, but cohesive structure allows the Planetarium and observatory of UIN Walisongo Semarang to become an effective and solid organization. The structure of the Planetarium and observatory of UIN Walisongo Semarang has evolved to cope with local, national, and international programs and projects. So far, the structure has proven to be able to meet the needs of the Planetarium and observatory of UIN Walisongo Semarang to manage cooperation and programs.

The above scheme can be explained as follows:

- 1. The management of this organization consists of a director. The director has the authority to control all working organizational units.
- 2. Secretariat in charge of controlling the administration of the organization.
- 3. Finance and General Affairs. This section is tasked with managing, maintaining and managing all the needs of the planetarium and observatory buildings both related to academic and non-academic.
- 4. The Research and Development Division is in charge of organizing and designing research and research in the fields of Astronomy and Astronomy.
- 5. The Training and Services Division is in charge of organizing services and designing training modules, organizing training in the field of Astronomy for all groups. (both for academics and public)
- Marketing and Publication Division, tasked with marketing Planetarium products and services as well as organizing publications or news related to institutional activities.
- 7. The Cooperation Division is in charge of organizing and making efforts to cooperate with other organizations both domestically and internationally.

B. Strategy

To describe the Vision and Mission, the planetarium and observatory of UIN Walisongo Semarang take the following strategies:

1. Training and service

To meet the needs of the community and other organizations, the Planetarium and observatory of UIN Walisongo Semarang, UIN Walisongo Semarang, provides various training models in collaboration with astronomy study programs, Faculty of Sharia and Law, UIN Walisongo, namely:

- a. Telescope Operational Training
- b. NPL 322 Plus Total Station Operational Training
- c. Theodolite operational training
- d. Rukyat al hilal training
- e. Prayer time schedule training
- f. Qibla direction measurement training

2. Edutainment

One of the strategies for the Planetarium and observatory of UIN Walisongo Semarang, UIN Walisongo Semarang, especially in the field of education, is to organize a series of shows, short films and performances that introduce visitors to space and cosmology.

Visitors can see:

- a. Films about the solar system and galaxies
- b. The origin of life on Earth
- c. The Beauty of the Earth Film
- d. Space exploration documentary
- e. The mystery of life in outer space (exoplanets)
- f. Live Streaming of eclipse observation and rukyatul hilal
- g. Space exploration, etc.

3. Research and development

Planetarium and observatory of UIN Walisongo Semarang UIN Walisongo Semarang conducts various researches and services in collaboration with other astronomy study programs. Various studies have been carried out by the Planetarium and observatory of UIN Walisongo Semarang, UIN Walisongo Semarang, namely:

- a. Periodic research for new moon observations
- b. Periodic research for solar data observation
- c. Research on eclipses
- d. Research on celestial bodies related to astronomy
- e. Research on celestial bodies related to culture, social, and local wisdom.

4. Human resources and facilities

As a modern organization, the planetarium and observatory of UIN Walisongo Semarang have the following inputs:

a. Office

The planetarium and observatory of UIN Walisongo Semarang occupies the Secretariat Building, Lt. 2 Campus 3 UIN Walisongo Semarang on Jl. Walisongo KM. 3-5 Semarang 50185.

b. Facilities and Infrastructure

The planetarium and observatory of UIN Walisongo Semarang is equipped with adequate facilities and infrastructure, such as computers, laptops, LCDs, televisions, digital cameras, handycams, internet, furniture, cupboards and other supporting devices. In addition, the facilities and infrastructure as well as the existing equipment facilities at the planetarium and observatory of UIN Walisongo.

c. Information System

The planetarium and observatory of UIN Walisongo Semarang is equipped with an adequate information system, such as telephone network, internal phone, facsimile, internet network, intranet and homepage (website) that can be accessed easily via the internet.

d. Funding

The planetarium and observatory of UIN Walisongo Semarang has two sources of funds, namely: the result of collaboration with outside parties and donations from other parties that are not binding. The fund allocation and management system is based on the Expenditure Budget Plan (RAB) and Operational Guidelines (PO) which are prepared based on member meetings. For accountability for the use of funds, the financial audit is carried out in two stages, namely: 1) the internal examination stage by members of the institution in a member meeting, and 2) the external examination stage where the institution invites an independent auditor to conduct a thorough examination which is usually carried out once a year.

5. Network and Cooperation

The planetarium and observatory of UIN Walisongo Semarang has established various collaborations and networks with national and international institutions. Among the national institutions that collaborate with our planetarium are the Jakarta Observatory and Planetarium, the Boscha Lembang Observatory in Bandung, BMKG, BIG and private institutions such as IMAH Noong, West Java, and several planetariums in Souteast Asia.

6. Marketing Strategy

The specificity of the system in service marketing causes in the service business there are three types of marketing called The Service Marketing Triangle (Kotler, 2006:89).

- a. External Marketing (External Marketing) describes the normal work that companies do to prepare, price, distribute and promote services to consumers. In this case, the strategy that can be done by the planetarium is through cooperation with travel agents and the tourism department.
- b. Internal Marketing (Internal Marketing) explains the work done by the company to train and motivate its employees to serve customers well. The steps taken are promotions to visiting guests such as comparative studies and other programs.
- c. Interactive Marketing (Interactive Marketing) describes the skills of employees in serving consumers. This is important because service consumers evaluate quality not only through its technical quality (for example, does the differentiation work) but also through its functional quality (for example, does the surgeon show attention and inspire confidence). The steps in this type of strategy are done through social media platforms such as websites, YouTube, Instagram that make it possible to respond to questions. In addition,

marketing is also strengthened by way of promotion to the field directly.

C. Concept of Planetarium UIN Walisongo based on Unity of Sciences

The unity of science paradigm is a solution to avoid the dichotomy between religious science and science which is the cause of the decline of Muslims. Unity of Science, such as the integration of religious knowledge and science, needs to be implemented through the curriculum in courses/subjects in Indonesian Islamic educational institutions.⁵⁷

The strategy for implementing the *Wahdatul Ulum* (Unity of Science) paradigm in the curriculum is as follows⁵⁸:

Humanization of Islamic sciences. Humanization in question is to construct Islamic sciences so that they are more touching and provide solutions to the real problems of Indonesian human life. The strategy of humanization of the Islamic sciences includes all efforts to integrate the universal values of Islam with modern science in order to improve the quality of life and human civilization. In this strategy, researchers then plan and discuss a planetarium screening film that integrates astronomy with religion. Then the researcher bought the rights to show a film about eclipse education that integrates religious values, history and local wisdom. The film is titled Samagaha produced by Imah Noong Lembang Bandung West Java. In addition, researchers also created a planetarium si-

⁵⁷ Muhyar Fanani, Buku Ajar Falsafah Kesatuan Ilmu, Semarang: UIN Walisongo, 2015, 274.

⁵⁸ Muhyar Fanani, Buku Ajar Falsafah Kesatuan Ilmu, Semarang: UIN Walisongo, 2015, 274.

mulation curriculum by utilizing digistar 6 technology which is basically only for simulating celestial bodies in general. The planetarium simulation curriculum includes;

- 1. Early simulation of prayer time
- 2. Simulation of rukyat al hilal
- 3. Eclipse simulation

Spiritualization of science. Spiritualization is to provide a foothold of divine values (Ilahiyah) and ethics to the secular sciences to ensure that basically all sciences are oriented towards improving the quality/sustainability of human life and the universe, not sacrilege/destruction of both. The strategy of spiritualization of modern sciences includes all efforts to build new knowledge based on the awareness of the unity of knowledge, all of which are sourced from the verses of Allah, whether obtained through prophets, exploration of reason, or exploration of nature.

In this strategy, researchers propose a plan for a planetarium gallery on the first floor that displays educational information about Astronomy that is integrated with Islamic science. A gallery in a planetarium is a commonplace, because what researchers have seen and observed in planetariums in Indonesia and in Southeast Asia such as Malaysia and Thailand have educational galleries but there is no element of unity of sciences.

The gallery includes the following;

- 1. Display Sky objects along with *kauniyah* verses
- 2. Display the history of astronomy from the perspective of Islamic and non-Islamic civilizations

Revitalizing local wisdom. Revitalizing local wisdom is reinforcing the noble teachings of the nation. The local wisdom strategy consists of all efforts to remain faithful to the noble teachings of local culture and its development in order to strengthen the nation's character.

For this strategy, the researchers translated some of the films in the UIN Walisongo planetarium into several regional languages. Researchers and the team have dubbed one of the films owned by the UIN Walisongo planetarium entitled Journey to the center of milky-way which is in English into Indonesian and Javanese language.

In addition to video dubbing, there is something very important in an organization or institution, that is the logo as an identity. in this case, researchers have held a logo making competition that is adapted to the vision and mission of UIN Walisongo and also the UIN Walisongo Planetarium. There are 20 logos obtained from 20 participants. From the 20 logos, the top 5 were selected by the jury. Then from the top 5 it was presented to the leadership of UIN Walisongo to determine 3 winners.

There is also a corner display of the "Turast" classical study exhibition/ astronomy manuscripts, and classic works of astronomy equipment. This turast corner is also part of the UIN Walisongo planetarium gallery.

D. Guidelines for the Management and management of UIN Walisongo Planetarium Semarang

In order to achieve the vision and mission in accordance with the basic budget and household budget of UIN Walisongo Planetarium, it is necessary to create a management and managerial guideline for UIN Walisongo Planetarium Semarang. The author made it and displayed it in Indonesian due to its application in the Semarang region of Indonesia.

KETENTUAN UMUM

- Planetarium adalah gedung teater untuk memperagakan simulasi susunan bintang dan benda-benda langit. Atap gedung biasanya berbentuk kubah setengah lingkaran. Di planetarium, penonton dapat belajar mengenai pergerakan benda-benda langit di malam hari dari berbagai tempat di bumi dan sejarah alam semesta.
- Observatorium adalah sebuah lokasi atau bangunan yang mempunyai perlengkapan yang diletakkan secara permanen agar dapat melihat langit dan peristiwa yang berhubungan dengan angkasa.
- 3. Kampus Merdeka adalah kebijakan yang dikeluarkan oleh Kemendikbudristek / Kementerian Agama dengan memberikan hak kepada Mahasiswa untuk mengambil mata kuliah di luar program studi selama 1 (satu) semester dan berkegiatan di luar perguruan tinggi selama 2 (dua) semester.
- 4. Magang (*Internship*) adalah penempatan sivitas akademika berasal dari internal atau eksternal UIN Walisongo

Semarang pada planetarium dan observatorium selama periode tertentu;

- 5. Penelitian Bersama (*Joint Research*) adalah penelitian yang dilakukan oleh sivitas akademika UIN Walisongo Semarang bersama sivitas akademika perguruan tinggi mitra baik di dalam maupun luar negeri;
- 6. *Student Mobility* atau *International Academic Exposure* merupakan program untuk memberikan pengalaman internasional kepada mahasiswa dengan mengunjungi dan belajar di perguruan tinggi mitra di luar negeri.
- 7. Mitra adalah perguruan tinggi atau lembaga lain yang telah melakukan kerja sama dengan UIN Walisongo Semarang dalam penyelenggaraan program pendidikan, pelatihan maupun penempatan mahasiswa untuk mengikuti pendidikan atau pelatihan yang dilakukan oleh Planetarium dan Observatorium UIN Walisongo Semarang baik dari dalam maupun luar negeri.
- 8. Kalender Astronomis adalah kalender yang memuat peristiwa-peristiwa dan fenomena-fenomena astronomis seperti kenampakan bulan sabit, konjungsi benda langit, oposisi benda langit, kenampakan rasi bintang/buruj, dan fenomena astronomis lainnya dalam satu tahun.
- Sponsorship adalah bantuan berupa produk dan atau layanan yang diberikan lembaga / perusahaan kepada UIN Walisongo Semarang melalui planetarium dan observatorium sebagai ganti promosi suatu produk, event atau merek.

TUJUAN

Tujuan pedoman ini adalah untuk:

- 1. Mewujudkan kegiatan administratif yang tertib dan lancarMe.
- 2. Mewujudukan tata kelola keuangan yang *transparan, akuntable* bagi Planetarium dan Observatorium UIN Walisongo Semarang.
- Memberikan kejelasan sistem, mekanisme dan prosedur kepada individu, instansi maupun pihak lain terkait pengelolaan Planetarium dan Observatorium UIN Walisongo Semarang.
- Memberikan kemudahan bagi UIN Walisongo Semarang dalam memberikan pelayanan kepada individu, instansi maupun pihak lain terkait pengelolaan Planetarium dan Observatorium UIN Walisongo Semarang.
- 5. Menjadi landasan bagi upaya pengembangan pelayanan prima kepada sivitas akademik UIN Walisongo Semarang.

KEDUDUKAN, STRUKTUR PENGELOLA PLANETARIUM DAN OBSERVATORIUM

Bagian Kesatu

Kedudukan Planetarium dan Observatorium

- 1. Planetarium dan Observatorium berkedudukan sebagai Unit Pelaksana Teknis (UPT) atau yang disetarakan dengan UPT.
- 2. Planetarium dan Observatorium dipimpin oleh seorang kepala
- 3. Kepala Planetarium dan Observatorium ditunjuk dan diangkat oleh Rektor

4. Kepala Planetarium dan Observatorium bertanggung jawab kepada Rektor melalui Wakil Rektor Bidang Administrasi Umum, Perencanaan dan Keuangan.

Bagian Kedua

Struktur Pengelola Planetarium dan Observatorium Pengelola Planetarium dan Observatorium terdiri atas:

- 1. Pengarah
- 2. Kepala
- 3. Sekretaris
- 4. Staff Ahli bidang Planetarium
- 5. Staff Ahli bidang Observatorium
- 6. Staff Marketing dan Publikasi
- 7. Staff Administrasi dan Umum
- 8. Staff Teknis

PLANETARIUM

Bagian Kesatu

Tugas Pengelola Bidang Planetarium

Pengelola bidang Planetarium mempunyai tugas:

- 1. Menyusun bahan rencana strategis, rencana kerja dan anggaran Planetarium.
- 2. Melaksanakan kegiatan sesuai dengan rencana strategis, rencana kerja dan anggaran Planetarium.
- 3. Menyusun dan mengembangkan standar oprasional prosedur (SOP) bidang Planetarium.

- 4. Menyusun rencana kebutuhan dan peralatan operasional pertunjukan.
- 5. Menyusun rencana pemeliharaan dan perawatan (maintenance) bidang Planetarium.
- 6. Menyusun rencana kegiatan pertunjukan Planetarium, Multimedia, dan Pameran.
- 7. Melaksanakan pertunjukan Planetarium, Multimedia, dan Pameran.
- 8. Melaksanakan kerja sama dengan lembaga sejenis di dalam negeri dan luar negeri.
- 9. Melaksanakan riset/penelitian dan pengabdian kepada masyarakat berbasis pengembangan Planetarium.
- 10. Menyusun perencanaan publikasi dan pemasaran Planetarium; menyusun konsep dan desain pertunjukan Planetarium.
- 11. Membuat laporan kegiatan bidang Planetarium untuk disampaikan kepada rektor.

Bagian Kedua

Layanan di Bidang Planetarium

- 1. Layanan di Bidang Planetarium meliputi pertunjukan, praktikum dan magang.
- 2. Pertunjukan Planetarium terdiri atas:
 - a. Pertunjukan reguler;
 - b. Pertunjukan khusus.
- 3. Penyelenggaraan pertunjukan reguler mencakup kategori:
 - a. Pertunjukan untuk anak;

- b. Pertunjukan untuk umum;
- 4. Pertunjukan anak ditujukan untuk anak usia 2 tahun hingga 12 tahun (jenjang pendidikan PAUD hingga SD).
- Pertunjukan umum ditujukan untuk pengunjung berusia lebih dari 12 tahun (jenjang pendidikan SMP hingga UNI-VERSITAS)
- 6. Penyelenggaraan pertunjukan khusus dilaksanakan untuk tamu resmi UIN Walisongo Semarang setelah mendapatkan rekomendasi dari rektor atau wakil rektor;
- 7. Penyelenggaraan praktikum dan magang diperuntukkan bagi:
 - a. Internal civitas akademik UIN Walisongo Semarang;
 - b. Pihak eksternal UIN Walisongo Semarang.

Bagian Ketiga

Jadwal Pertunjukan

1. Pertunjukan Planetarium reguler dijadwalkan sebagai berikut:

No.	Hari	Waktu	Keterangan
1	Senin		Maintenance (tidak ada pertunjukan)
2 Selasa-		Sesi 1: pukul 10.00-11.00 WIB	
Jumat	Jumat	Sesi 2: pukul 13.30-14.30 WIB	
No.	Hari	Waktu	Keterangan
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3	Sabtu	Sesi 1: pukul 08.30-09.30 WIB	
		Sesi 2: pukul 10.00-11.00 WIB	
		Sesi 3: pukul 13.30-14.30 WIB	
		Sesi 4: pukul 15.30-16.00 WIB	

- 2. Waktu pertunjukan Planetarium khusus dilaksanakan dengan ketentuan:
 - a. Jika berkesesuaian dengan jadwal reguler maka waktu pertunjukan dilaksanakan bersamaan dengan pertunjukan reguler;
 - Jika tidak berkesesuaian dengan jadwal reguler maka waktu pertunjukan dilaksanakan secara terpisah sesuai dengan arahan rektor atau wakil rektor.

Bagian Keempat

Pengunjung Planetarium

- 1. Pengunjung planetarium dikategorikan menjadi:
 - a. Pengunjung kolektif (rombongan)
 - b. Pengunjung personal.
- Pengunjung kolektif (rombongan) adalah pengunjung planetarium yang menunjukkan surat keterangan/permohonan dari lembaga/instansi dengan jumlah pengunjung minimal 40 orang dalam sekali pertunjukan.
- 3. Pengunjung personal adalah pengunjung individual atau pengunjung yang tidak memenuhi kriteria sebagai pengunjung kolektif (rombongan).

4. Pengunjung kolektif (rombongan) diberikan diskon sebesar 15% dari total tarif personal.

Bagian Kelima

Standard Operating Procedure (SOP) Planetarium

- 1. Pertunjukan Planetarium dilaksanakan oleh minimal 2 orang staff ahli Planetarium.
- 2. Konten dan jadwal pertunjukan Planetarium disesuaikan dengan kategori pertunjukan (Anak dan Umum).
- Pertunjukan yang dilakukan di luar jam kerja dan atau di luar hari kerja misal hari Sabtu dihitung sebagai kerja lembur.
- 4. Pertunjukan bagi pengunjung dari sekolah-sekolah, Lembaga/Instansi atau Travel/Biro Perjalanan dilaksanakan sesuai jadwal pertunjukan.
- 5. Pertunjukan bagi pengunjung dari Sekolah-sekolah, Lembaga/Instansi atau Travel/Biro Perjalanan dapat dilakukan dengan mekanisme *booking* (pesan) minimal 2 hari sebelum pertunjukan dimulai.
- 6. Alur permohonan kunjungan dari Sekolah-sekolah, Lembaga/Instansi, atau Travel/Biro Perjalanan dengan mekanisme *booking* (pesan) adalah sebagai berikut:
 - a. Menyampaikan pemberitahuan kunjungan secara resmi melalui Surat Permohonan Kunjungan yang ditujukan kepada:
 - b. Kepala Panetarium UIN Walisongo Semarang
 - c. Gedung Planetarium
 - d. Jalan Prof. Dr. Hamka (Kampus III), Ngaliyan, Kota Semarang 50185

- e. Telepon 081326089460
- f. Email: planetarium@walisongo.ac.id
- g. Menunjukkan bukti pelunasan pembayaran tiket pertunjukan.
- 7. Setiap pengunjung wajib mematuhi segala ketentuan sebagai berikut:
 - a. Pengunjung datang ke planetarium sesuai dengan jadwal pertunjukan
 - b. Pengunjung dilarang memasuki area operator Planetarium.
 - c. Dilarang merokok di dalam ruang pertunjukan.
 - d. Dilarang membawa makanan dan minuman.
 - e. Pengunjung wajib ikut menjaga kebersihan ruang pertunjukan.
 - f. Pengunjung dilarang membawa senjata tajam atau sejenisnya.
 - g. Pengunjung dilarang membawa hewan peliharaan.
 - h. Pengunjung dilarang memakai alas kaki di dalam ruang pertunjukan.
 - i. Pengunjung dilarang membawa minuman keras dan obat psikotropika.
 - j. Pengunjung dilarang merekam konten / film pertunjukan utk kepentingan apapun.
 - k. Pengunjung dilarang memotret dengan menggunakan *flash* selama pertunjukan berlangsung.
 - Untuk pengunjung Planetarium dari kategori pelajar tingkat SD dan PAUD, wajib didampingi oleh pembimbing dari sekolah atau orang tua masing-masing.
- 8. Pertunjukan Planetarium dapat dibatalkan jika:

- a. Peralatan Planetarium mengalami kerusakan;
- b. Peralatan Planetarium sedang dalam *maintenance*/ perawatan;
- c. Terdapat kendala jaringan dan/atau listrik.
- 9. Pelaksanaan magang atau praktikum dari unsur internal UIN Walisongo Semarang harus mendapatkan persetujuan kepala Planetarium dan Observatorium
- 10. Pelaksanaan magang atau praktikum dari mitra eksternal UIN Walisongo dikenakan biaya yang besarnya diatur oleh ketentuan rektor.

Bagian Keenam

Pengembangan Konten Planetarium dan

Maintenance

- 1. Pengelola Planetarium wajib mengembangkan konten (film pertunjukan) secara berkala.
- 2. Pengelola Planetarium wajib merencanakan pembelian konten (film pertunjukan) baru minimal 2 tahun sekali.
- 3. Pengelola Planetarium wajib melaksanakan *maintenance* gedung, peralatan, dan fasilitas Planetarium secara berkala.
- 4. *Maintenance* gedung dan fasilitas Planetarium dilaksanakan setiap bulan pada hari Senin setiap awal bulan.
- 5. *Maintenance* peralatan Planetarium dilaksanakan setiap hari Senin pada setiap pekan.
- 6. Anggaran pembelian konten (film pertunjukan) dan *maintenance* dibebankan pada anggaran UIN Walisongo Semarang.

OBSERVATORIUM

Bagian Kesatu

Tugas Pengelola Bidang Observatorium

Pengelola bidang Observatorium mempunyai tugas:

- 1. Menyusun bahan rencana strategis dan rencana kerja dan anggaran Observatorium.
- 2. Melaksanakan kegiatan sesuai dengan rencana strategis, rencana kerja dan anggaran Observatorium.
- 3. Menyusun dan mengembangkan standar oprasional prosedur (SOP) bidang Observatorium.
- 4. Menyusun rencana kebutuhan dan peralatan operasional observasi.
- 5. Menyusun rencana pemeliharaan dan perawatan (maintenance) bidang Observatorium.
- 6. Merencanakan kegiatan observasi, riset, inovasi dan pengembangan Observatorium.
- 7. Melaksanakan observasi, riset, inovasi dan pengembangan Observatorium.
- 8. Melaksanakan kerja sama dengan lembaga sejenis di dalam negeri dan luar negeri.
- 9. Melaksanakan riset/penelitian dan pengabdian kepada masyarakat berbasis pengembangan observasi, riset, inovasi dan pengembangan Observatorium.
- 10. Menyusun perencanaan publikasi dan hasil riset observasi.
- 11. Membuat laporan kegiatan bidang Observatorium untuk disampaikan kepada rektor.

Bagian Kedua

Layanan di Bidang Observatorium

Layanan di Bidang Observatorium meliputi:

- 1. Layanan di Bidang Observatorium meliputi observasi, praktikum, magang, pelatihan, pendidikan, dan pengabdian masyarakat
- 2. Observasi terdiri atas:
 - a. Observasi reguler;
 - b. Observasi Insidental.
- 3. Observasi reguler mencakup kategori:
 - a. Rukyatul hilal rutin tiap awal bulan kamariah
 - b. Observasi benda langit sesuai dengan kalender astronomis
 - c. Observasi yang diagendakan oleh Pengelola bidang Observatorium
- 4. Observasi insidental meliputi :
 - a. Observasi yang berasal dari permintaan hasil dari kerjasama observatorium dengan mitra
 - b. Observasi dengan tetamu UIN Walisongo
- 5. Penyelenggaraan observasi insidental dilaksanakan untuk tamu resmi UIN Walisongo Semarang setelah mendapatkan rekomendasi dari rektor atau wakil rektor;
- 6. Penyelenggaraan praktikum dan magang di observatorium diperuntukkan bagi:
 - a. Internal civitas akademik UIN Walisongo Semarang;
 - b. Pihak eksternal UIN Walisongo Semarang.

- 7. Observatorium memberikan pelayanan lain berupa pelatihan, antara lain :
 - a. Pelatihan Hisab Berbasis Kitab Klasik
 - b. Pelatihan Hisab Berbasis Metode Kontemporer
 - c. Pelatihan Instrumentasi Hisab Rukyat
 - d. Pelatihan pengambilan, analisis dan olah data terkait hisab rukyat
 - e. Pelatihan Pembuatan Jadwal Imsakiyah dan Kalender Hijriyah
- 8. Penyelenggaraan pendidikan dan pengabdian kepada masyarakat meliputi;
 - a. Pengukuran Arah Kiblat
 - b. Pembuatan Jadwal Imsakiyah
 - c. Rukyatul Hilal bulan Kamariah

Bagian Ketiga

Jadwal Observasi

- 1. Jadwal observasi reguler disesuaikan dengan kalender astronomis
- 2. Jadwal observasi insidental dilakukan dengan ketentuan:
 - a. Jika berkesesuaian dengan jadwal observasi reguler maka waktu observasi dilaksanakan bersamaan dengan observasi reguler;
 - b. Jika tidak berkesesuaian dengan jadwal observasi reguler maka waktu observasi dilaksanakan secara terpisah sesuai dengan arahan rektor atau wakil rektor.

- 3. Observasi dapat dilakukan di luar gedung Observatorium dan Planetarium UIN Walisongo Semarang
- Observasi yang dilakukan di luar Planetarium harus mendapatkan persetujuan dari Kepala Planetarium dan Observatorium
- 5. Pelaksanaan Observasi yang mengharuskan untuk bermalam harus berkoordinasi dan mendapatkan persetujuan dari Kepala Planetarium dan Observatorium
- 6. Pelaksanaan observasi dilaksanakan secara fleksibel (tidak selalu terikat dengan jam kerja)
- Observasi yang dilakukan di luar jam kerja dan atau di luar hari kerja misal hari Sabtu dihitung sebagai kerja lembur.

Bagian Keempat

Standard Operating Procedure (SOP) Observatorium

- 1. Observasi dapat dilaksanakan oleh minimal 2 orang pengelola Observatorium.
- 2. Peserta observasi di ruang observatorium UIN Walisongo maksimal 6 orang.
- Observasi yang melibatkan peserta dari luar wajib memberitahukan kepada Kepala Planetarium minimal 3 hari sebelumnya
- 4. Setiap pengunjung observatorium wajib mematuhi segala ketentuan sebagai berikut:
 - a. Dilarang merokok di dalam ruang observatorium.
 - b. Dilarang membawa makanan dan minuman.
 - c. Pengunjung wajib ikut menjaga kebersihan ruang observatorium

- d. Pengunjung dilarang membawa senjata tajam atau sejenisnya.
- e. Pengunjung dilarang membawa hewan peliharaan.
- f. Pengunjung dilarang membawa minuman keras dan obat psikotropika.
- 5. Bagi pengunjung yang hendak menggunakan fasilitas/ peralatan observatorium harus :
 - a. Mendapat ijin dari Kepala Planetarium dan Observatorium
 - b. Penggunaan peralatan harus didampingi oleh pengelola Planetarium dan Observatorium atau orang yang ditunjuk.
 - c. Pengguna mempunyai pengalaman penggunaan peralatan observasi atau setelah mendapatkan pelatihan singkat penggunaan peralatan observatorium UIN Walisongo Semarang
- 6. Observasi atau pengamatan benda langit dapat dibatalkan jika:
 - a. Peralatan observasi mengalami kerusakan;
 - b. Peralatan observasi sedang dalam maintenance/ perawatan;
 - c. Terdapat kendala cuaca misalnya hujan, atau jaringan dan/atau listrik.
- Pelaksanaan magang atau praktikum dari unsur internal UIN Walisongo Semarang harus mendapatkan persetujuan kepala Planetarium dan Observatorium

- 8. Pelaksanaan magang atau praktikum dari mitra eksternal UIN Walisongo dikenakan biaya yang besarnya diatur oleh ketentuan rektor
- 9. Peminjaman peralatan Observatorium untuk kepentingan penelitian atau yang lainnya harus mendapatkan ijin kepala Planetarium dan Observatorium

Bagian Kelima

Pengembangan Observatorium dan Maintenance

- 1. Pengelola Observatorium wajib mengembangkan riset berbasis observatorium secara berkala
- 2. Pengelola Observatorium wajib merencanakan pengembangan peralatan observasi.
- 3. Pengelola Observatorium wajib melaksanakan *maintenance* gedung, peralatan, dan fasilitas observasi secara berkala.
- 4. *Maintenance* gedung dan fasilitas Observatorium dilaksanakan setiap Senin awal bulan.
- 5. *Maintenance* peralatan Observatorium dilaksanakan setiap hari Senin pada setiap pekan.
- 6. Pembelian peralatan baru dilakukan setiap tahun dengan berorientasi pada skala kebutuhan akan pengembangan keilmuan, riset dan inovasi
- Anggaran pembelian dan pengebangan peralatan observasi dan *maintenance* dibebankan pada anggaran UIN Walisongo Semarang.

Bagian Keenam

Publikasi Hasil Riset/Observasi

- Publikasi hasil riset/observasi dimaksudkan untuk pengembangan dan memperluas rekognisi observatorium UIN Walisongo Semarang di tingkat global.
- Hasil observasi dan penelitian terkait Planetarium dan Observatorium dipublikasikan di media massa baik online maupun cetak, jurnal baik nasional maupun internasional dan prosiding.
- 3. Biaya terkait publikasi sepenuhnya ditanggung oleh Planetarium dan Observatorium UIN Walisongo Semarang

ANGGARAN DAN PENGELOLAAN KEUANGAN

Bagian Kesatu

Sumber Anggaran dan Pendapatan

- 1. Anggaran Planetarium dan Observatorium UIN Walisongo Semarang bersumber dari:
 - a. RM (Rupiah Murni)/ BOPTN
 - b. BLU (Badan Layanan Umum UIN Walisongo)
 - c. Sponsorship/ kerjasama dengan mitra
- 2. Pengelola Planetarium dan Observatorium UIN Walisongo Semarang harus merencanakan anggaran dan pendapatan setiap tahunnya.
- Besarmya anggaran dan pendapatan Planetarium dan Observatorium UIN Walisongo Semarang ditetapkan oleh rektor.

Bagian Kedua

Tarif Layanan

- Besaran tarif layanan pada Planetarium dan Observatorium UIN Walisongo Semarang ditentukan oleh keputusan rektor
- 2. Tarif layanan pada Planetarium dan Observatorium UIN Walisongo Semarang meliputi:
 - a. Tarif pertunjukan Planetarium perorangan:
 - 1) Tarif Anak
 - 2) Tarif Umum
 - 3) Civitas akademika UIN Walisongo
 - b. Tarif pertunjukan Planetarium kolektif:
 - 1) Tarif Anak
 - 2) Tarif Umum
 - 3) Civitas akademika UIN Walisongo
 - c. Tarif Pelatihan Hisab Berbasis Kitab Klasik
 - d. Tarif Pelatihan Hisab Berbasis Metode Kontemporer
 - e. Tarif Pelatihan Instrumentasi Hisab Rukyat
 - f. Tarif Pelatihan Pengambilan, Analisis dan Olah Data Hisab Rukyat
 - g. Tarif Pelatihan Pembuatan Jadwal Imsakiyah dan Kalender Hijriyah
 - h. Tarif Jasa Pengukuran Arah Kiblat
 - i. Tarif Jasa Pembuatan Jadwal Imsakiyah
 - j. Tarif Rukyatul Hilal bulan Kamariah di Observatorium UIN Walisongo Semarang
 - k. Tarif penggunaan fasilitas Planetarium dan Observatorium UIN Walisongo Semarang.

- Tarif layanan pada Planetarium dan Observatorium UIN Walisongo Semarang dievaluasi secara berkala
- Tarif layanan Planetarium dan Observatorium UIN Walisongo Semarang dibedakan untuk hari kerja (*weekdays*) dan akhir pekan (*weekend*) atau hari libur (*holiday*)
- 5. Tarif layanan Planetarium dan Observatorium UIN Walisongo Semarang dibedakan untuk pihak internal dan eksternal UIN Walisongo.

Bagian Ketiga

Pengelolaan Pendapatan

- Pengelola Planetarium dan Observatorium UIN Walisongo Semarang harus memberikan laporan pendapatan kepada rektor setiap tahun
- 2. Pendapatan Planetarium dan Observatorium UIN Walisongo Semarang disetorkan kepada rektor melalui rekening pengelolaan UIN Walisongo Semarang
- 3. Pendapatan Planetarium dan Observatorium UIN Walisongo Semarang bersumber dari:
 - a. Penjualan tiket pertunjukan Planetarium
 - b. Penjualan sovenir
 - c. Jasa, pelatihan, dan sewa fasilitas
 - d. Sponsorship
 - e. Kerjasama
 - f. Bantuan
- Pendapatan Planetarium dan Observatorium UIN Walisongo Semarang digunakan untuk promosi, maintenance dan pengembangan Planetarium dan Observatorium UIN Walisongo Semarang.

Bagian Keempat

Mekanisme Pembelian dan Pengembalian Tiket

- 1. Pembelian tiket pertunjukan Planetarium dapat dilakukan secara *online* atau di lokasi.
- 2. *Booking* pertunjukan di Planetarium dapat dilakukan minimal 2 hari sebelum pertunjukan dimulai.
- 3. Tiket pertunjukan yang sudah dibeli tidak dapat diuangkan kembali.
- 4. Pembelian tiket dapat dilakukan oleh perseorangan atau lembaga.
- 5. Pengambalian uang tiket (*refund*) hanya dapat dilakukan bila terdapat pembatalan pertunjukan planetarium karena mengalami kendala tekhnis.
- 6. Tekhnis pengembalian uang tiket (*refund*) diatur lebih lanjut oleh kepala planetarium

SPONSORSHIP

- 1. Pengelola planetarium dan observatorium dapat menerima sponsorship dari pihak ketiga
- 2. Mitra sponsor mengajukan permohonan sponsorship kepada rektor melalui kepala planetarium dan observatorium.
- 3. Dana sponsorship diterima melalui rekening pengelolaan lembaga UIN Walisongo Semarang.
- 4. Mekanisme dan teknis sponsorship diatur oleh kepala planetarium dan observatorium.

From the UoS-based planetarium management guidelines above, several important products were obtained to run an

international-scale UoS-based planetarium role of game, as follows:

- 1. Organizational Structure
- 2. Adequate human resources
- 3. Standard operational procedures (SOP) include; Planetarium visit SOP, Planetarium show SOP, Apprenticeship SOP, Planetarium maintenance SOP, Planetarium facilities loan/rental SOP, Planetarium astronomy school SOP.
- 4. UIN Walisongo planetarium service tariff
- 5. UIN Walisongo planetarium astronomy school curriculum

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CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

A planetarium project with a futuristic and educational concept interactive at UIN Walisongo Semarang has the character of the outside world space that is unique and unusual due to the existence of another contact called the Unity of Sciences. In addition to the hall, this planetarium is the only planetarium in Indonesia managed by the State University of Religion. From the results of research conducted in Southeast Asian countries in order to observe and learn more about planetarium governance, several important points can be concluded;

- 1. That the important components of a planetarium are at least two things; show room and educational gallery
- 2. That the management of an international planetarium requires an international network with a number of foreign planetariums
- To carry out an important role in the world of education, research, and entertainment in the field of astronomy, An ideal structure is needed that performs its role to the maximum
- 4. To create a planetarium character that is different from other planetariums, the UoS approach used by the planetarium as a proposal will increase its own appeal.

B. Recommendations

In order to optimize the achievement of the vision and mission of Planetarium UIN Walisongo Semarang, researchers have several sara, among others;

- It is necessary to hold a further comparative study related to the maintenance of the digistar 6 system owned by the UIN Walisongo Planetarium
- 2. Connecting Mou with a number of planetariums in and outside the State
- 3. immediately realize a gallery based on Unity of sciences

C. Closing

Such is the Academic Report that the researcher made as a form of realization of the research plan that has been approved and funded by BOPTN LP2M UIN Walisongo Semarang. Of course, the writing of this report still has many errors and mistakes, so of course the researcher hopes for suggestions and criticism from reviewers and readers for future improvements.

Bibliography

- A.Seeds, Michael, *Horizon; Exploring The Universe*, California: 1987,439
- Bishop, J.E, *Planetarium A Challenge for Educators; Role and The Value of The Planetarium*, New York: The United Nations For International Space Year, 1992
- Brazell, B. D. *Planetarium instructional efficacy: A research synthesis*. Doctoral Dissertation, Texas A&M University, 2009..
- Cornelius, Ruben, *"Ilmu Dasar Astronomi"*, Banyumas: Agustus, 2022
- Darsa, S., Planetarium Dan Observatorium, Jakarta, 2014,
- Deasy, Pesoth, *Perancangan Planetarium di Manado Analogi sebagai Strategi Desain*. Program Studi S1 Arsitektur. Jurusan Arsitektur. Fakultas Teknik. Universitas Sam Ratulangi Manado, 2011.
- Diane , Julia Plummer, Alicia Kocareli & Cynthia Slagle (2014) Learning to Explain Astronomy Across Moving Frames of Reference: Exploring the role of classroom and planetarium-based instructional contexts, International Journal of Science Education, 36:7, 1083-1106, DOI: 10.1080/09500693.2013.843211
- Fanani, Muhyar *Buku Ajar Falsafah Kesatuan Ilmu*, Semarang: UIN Walisongo, 2015

https://support.es.com/Software/Digistar6/Archive.aspx

I. Bernard Cohen, Harold ,*Revolution in Science* (Cambridge-Landon: The Belknap Press of Harvard University Press, 1985 John Sheldrake, Management Theory Second Edition, Sidoarjo: Zifatama Publisher, 39

- Ka Chun, Yu,; Sahami, Kamran; Sahami, Victoria; Sessions, Larry C., Using A Digital Planetarium For Teaching Seasons To Undergraduate, Journal of Astronomy & Earth Sciences Education, v2 n1 p33-50 Jun 2015, https://eric. ed.gov/?id=EJ1101071
- Kuhn, Thomas *The Structure of Scientific Revolutions* London: The University of Chicago Press. Ltd., 1970
- Laporan Kegiatan Workshop Penyusunan Kurikulum Berbasis Unity of Sciences IAIN Walisongo Tahun 2013, 3
- Muhadjir, Noeng, *Metodologi Penelitian Kualitatif*, Yogyakarta : Rake Sarasin, Ed. III, 1996, 88.
- Musonnif, Ahmad ,Ilmu Falak; Metode Hisab Awal Waktu Shalat, Arah Kiblat, Hisab Urfi Dan Hisab Hakiki Awal Bulan, Yogyakarta: 2011
- Pribadi, Pandu, "Ilmu Dasar Astronomi", Jakarta: 2022
- Qarid, Muhammad dkk, Book Chapter; Astronomi Islam, Medan: UMSU Press, 2021, 19
- R Terry, George, *Prinsip-Prinsip Manajemen*, Jakarta: Bumi Aksara, 2012, 15
- Riswanto, "Dasar-Dasar Astronomi dan Fisika Kebumian", Metro: November, 2014, 2BB. Asmoro, E-Journal Universitas Atama Jaya Yogyakarta; Tinjauan Proyek Observatorium dan Museum Antariksa, (Yogyakarta: 2015) bab 2
- Saraswati, Putri Mardlijah, "Analisis dan Kontrol Optimal Sistem Gerak Satelit Menggunakan Prinsip Minimum Pontryagin", JURNAL SAINS DAN SENI ITS, (Surakarta: 2017) Vol.6, No.2,45

- Sari,. A. Planetarium Medan Arsitektur Metafora. Jurusan Arsitektur, Fakultas Teknik. Universitas Sumatera Utara. Medan, 2010
- Schultz, S. K., & Slater, T. F. Who Are The Planetarians? A Demographic Survey Of Planetarium - Based Astronomy Educators. Journal of Astronomy & Earth Sciences Education (JAESE), 7(1), . (2020), 25–30. Retrieved from https://clutejournals.com/index.php/JAESE/article/ view/10355
- Sumadi Suryabrata, *Metodologi Penelitian*, Ed. I, Jakarta : PT. Raja Grafindo Persada, Cet. 10, 1997, 22.
- Watni Marpaung MA, "Pengantar Ilmu Falak", (Jakarta: 2015),

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