The Importance of Planetarium as Astronomy Education Center in Universitas Muhammadiyah Surabaya: A Preliminary Study

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Abstract. In this article, we study the importance of Astronomy in Education. This preliminary study aims to provide an overview of the importance of the existence of Planetarium as Astronomy Education Center at the University of Muhammadiyah Surabaya following the Vision and Mission of UMSurabaya, which is implemented in the Catur Dharma of Muhammadiyah, namely: Education and Teaching, Research, Community Service, and Al-Islam and Kemuhammadiyahan. We argue that the role of Planetarium will support mainly on learning Astronomy to brighten all students to literate science. In addition, we mention the significance of astronomy as a part of the integration of science and Islam in the Al-Islam and Kemuhammadiayan course. We also point out the economic opportunities and benefits of Planetarium in the UMSurabaya.

Keywords: Astronomy · Education Center · Planetarium

1 Introduction

The beautiful Sky object may interest all people in the world. Astronomy can be found easily in many places and cultures worldwide. Ancient people started planting or harvesting and doing some daily activities by looking up a sign from the sky. Moreover, they were also searching for their existence, where they live among other astronomical objects even though asking for where we are come from and live on Earth. The primitive astronomical observation in the past helps us to answer these questions. For instance, Aristoteles concluded that Earth is a sphere through lunar eclipse observation. Aristarchus calculated the ratio of distance and size of Earth-Moon and Earth-Sun by comparing the moon phase in the first quarter and lunar eclipse. Eratosthenes measured the shadow length in Alexandria when the day without shadow in Syne for measuring the Earth's circumference.

Astronomy is not just only a branch of science but also opens our minds giving the way of identifying our Universe. Achievement in astronomy is growing rapidly with the invention of exoplanets, distance objects, and black holes. However, many questions remain unsolved clearly. We did not understand the ultimate fate of our Universe, or do

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we have another universe beyond us? Is there a connection between sky phenomena and our climate? Answering these questions is essential to satisfying the basic human nature of curiosity. But in this pragmatic world, we are often faced with the question of why we know all that? Or, more simply, what are the benefits of Astronomy to address many of humanity's problems today, such as hunger, energy and climate change?

Robert Aitken, Lick Observatory's director, said that astronomy missions provide plenty of knowledge on the Universe and help humans learn modesty and knowing majesty [1]. In an article, C. Renée James described much great technology development based on the astronomical principle like global positioning system (GPS), image processing, and wireless internet [2], giving the evidence on astronomy as a part of the foundation of future technology offering a new paradigm on human of a vast and unimaginable [3].

It is not too easy to explain the importance of Astronomy. The journey from fundamental research and technological development to full commercialization can take long. It takes decades to transition from an initial conception, or invention, to a useful product or application of knowledge. Space projects such as The International Space Station (ISS) require research support conducted by Navigant Consulting, Inc. A global professional services company with decades of experience in evaluating research and development programs. Seven aspects are studied: Economic Valuation, Scientific Valuation, Economic Development of Space, Innovative Technology, Human Health, Earth Observation/Disaster Response, and Global Education [4].

Now we are interesting on studying the importance of astronomy, mainly of the educational side. The advantage of astronomy on education are their impact on the personal level and also in the society. Many previous research have proven that students associated with astronomical activities during elementary and secondary school may have promising career related in science and technology. They can follow scientific finding in the future (National Research Council, 1991). Astronomy utilizes curiosity, imagination, and a shared sense of exploration and discovery. Astronomy provides examples of alternative approaches to "scientific methods" - observation, simulation, and theory, instead of ordinary experimental and theoretical approaches. If taught correctly, Astronomy can enhance rational thinking and understanding of the nature of science through examples taken from the history of science and current issues [5].

The interest in the sky and the universal objects of Astronomy provides a great opportunity to publicize science through Astronomy. Astronomy can promote and increase public awareness, understanding, and appreciation of science and technology [5]. A country whose people have such awareness and understanding and are accustomed to a scientific mindset, and have the enthusiasm to know and understand its environment, will be a developed and prosperous country. Developed economies need scientifically and technologically skilled societies, who fill jobs in science or technology-related professions, such as computer science and engineering, and for many jobs that require knowledge of science in today's society, such as researchers, doctors, and construction [6]. An individual who is science literacy and has a scientific way of thinking will improve the ability to make decisions without being influenced by the opinions of others when they are faced with problems that have a large social impact [7]. Humans face various issues that demand personal decisions, such as their health, material and energy consumption,

and lifestyle, where an understanding of science can help them take actions or decisions based on information obtained to live a better life.

In Indonesia, Astronomy is not specifically included in the school curriculum. Astronomy is found in certain parts of the subject such as IPA for elementary and middle school students, and Geography or Physics for upper secondary school students. In higher Education, Astronomy is a subject in the Department of Astronomy, both undergraduate and postgraduate, and is part of the subjects taught in the physics education department of the Faculty of MIPA and the Department of Astronomy of the Faculty of Sharia. Given the importance of Astronomy and Astronomy education as well as the limited space on formal Education, it is necessary to study Astronomy on a non-formal path. Astronomy education in non-formal pathways such as Planetarium, Museum, Science centre, and Astronomy club.

This paper limits the discussion on the importance of the Planetarium in Astronomy education. Furthermore, this paper wants to present the importance of the Planetarium as a centre for Astronomy education at Muhammadiyah University.

2 Planetarium as Astronomy Education Center

2.1 What is Planetarium?

A planetarium is defined as a theatre in which a star projector can recreate the night sky. In recent years, special effects projectors, sound systems, and video projectors have also supplemented the star projector [8].

A planetarium is a specially-designed theater with a domed ceiling that can project a realistic image of the night sky indoors [9]. Planetarium, first used to educate about stars, planets, and constellations, planetariums today are unique immersive facilities often used to support Science, Technology, Engineering, and Mathematics (STEM) learning and to cross learning disciplines into art, culture, and history.

The modern Planetarium, with the introduction of digital full-dome video and the ability to synchronize it with opto-mechanical projectors and to control it easily, the entertainment capabilities of the theater have been greatly enhanced and have joined the education activities in many domes. For this reason, planetariums can now be found not only in schools and museums but also in department stores, shopping centers, theme parks, airports, hotels, and totally new types of venues. The purpose of establishing the planetarium has now evolved, not only for educational purposes only, but also for profit purposes.[1]

2.2 What is Planetarium Show?

Today's planetariums and star theatres give a variety of presentations. They can be defined in three general categories [8]:

1. Live "What's Up Tonight?" lectures are very popular and give audience and presenter a chance to interact. These programs are useful for teaching the sky and presenting the latest news from the field of astronomy.

[1] https://www.goto.co.jp/english/whats_a_planetarium/significance/.

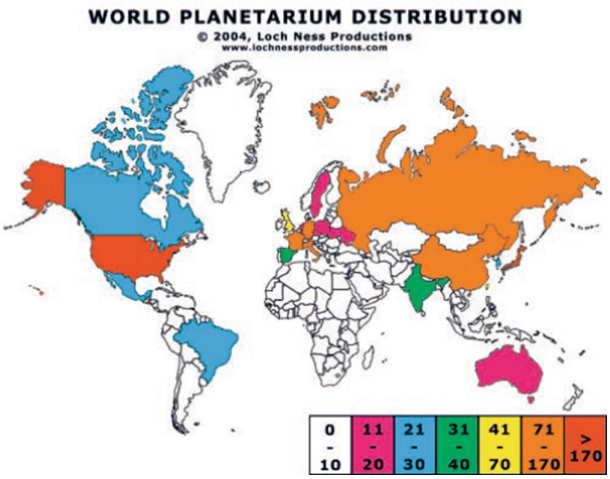

Fig. 1. This graphic shows the distribution of planetariums worldwide, colour.coded by number. Courtesy Mark C. Petersen, Loch Ness Productions.

2. Pre-recorded documentary-style programs presented with images, narration and soundtrack. These generally use slides and video coordinated with a soundtrack. More recent shows created for the full dome video community feature complete video presentations (including animations and other material).
3. Laser shows, concerts, weddings, and other assorted presentations.

Information from research institutions is often a vital part of many planetarium presentations. In this sense, planetarium theatres can function as a media outlet for education and public outreach offices at research facilities. In addition, these theatres are an effective magnet for the "motivated, interested public" that education and public outreach offi ces seek to reach. Oleh karena itu, banyak ditemukan bangunan planetarium berada tidak jauh dari observatorium (Fig. 1).

The first optical-mechanical Planetarium was introduced in Germany in 1923. Now thousands of planetariums of many types and sizes exist worldwide in schools, museums, science centers, and other locations. Portable planetariums are also used and expand educational possibilities to far-flung audiences. It is estimated that over 1 billion people have been served by planetariums since their introduction [9].

Based on a graphic compiled in 2004 released by Loch Ness Productions, It shows that more than half of the world's Planetarium are located in North America, with large numbers in Asia and Europe, and relatively few in other parts of the world. If we consider distribution by country, we find that half are in te US, more than 300 in Japan and Germany ranks third with 100. Nineteen countries have ten or more Planetarium.

How Many Planetariums Today? The worldwide planetarium community is growing, with more than 3,500 facilities spread across every continent except Antarctica.[2] Roughly

[2] http://www.aplf-planetariums.org/en/index.php.

one-third of these facilities are in universities and/or public venues, while the rest are associated with pre-college schools.

2.3 Planetarium in Indonesia

There are currently nine planetariums in Indonesia, namely:

1. Planetarium dan Observatorium Jakarta
2. Planetarium Jagad Raya Tenggarong
3. Museum dan Planetarium Loka Jala Crana Surabaya
4. Planetarium Skyworld Indonesia TMII
5. Planetarium Taman Pintar Yogyakarta
6. Musholatorium An-Najm Imah Inoong Lembang
7. Planetarium UIN Mataram
8. Planetarium dan Observatorium UIN Walisongo
9. Planetarium Agro Techno Park Ngrambe (in the planning)

2.4 The Strengths and Education Value of Planetarium

In defining the role that planetariums play, especially in Education, it's useful to review their strengths. We all know that planetariums can reproduce the night sky for any place on Earth on any day of the year for many years past and future, creating a view that simulates the three-dimensional "backyard" sky. And that they can accurately reproduce the apparent motions and cycles of the sky –in a speeded-up fashion so people can see what happens over time [10]. Any topic involving the appearance of the sky can be viewed in three dimensions. Text and chalkboard diagrams cannot reproduce the omnidirectional perspective of the Planetarium. Classroom models normally present an outside earth perspective, while the Planetarium recreates the from-earth perspective [11]. Planetariums also create environments that encompass the audience, bringing them into the experience in a way that classroom, book, TV, or computer cannot. They can combine and effectively use audiovisual technology to help create these experiences. And they possess tremendous flexibility in how these audiovisual resources can be used [11].

The people of the world today, especially those living in cities, grow in indifference to the sky. This is caused by light pollution that removes the view of the stars and planets in the sky. Very few children, except those living in the rural, have ever seen The Milky Way. A group of billions of stars that form a light strip look like a milk spill. The Planetarium solves this by showing the Milky Way and other objects in a dark sky simulation. These strengths allow the Planetarium to effectively demonstrate astronomical principles and present and reinforce concepts and information in ways that other media cannot.

Dr Jeanne Bishop, Chair of the IPS Education Committee, in an article entitled The Value of Education in The Planetarium: a White Paper [9], mentions the values of Education in the Planetarium are

1) **Unique, Inspirational Environment:** Every Planetarium immerses visitors in a 3-D environment that evokes realism. The sight of stars appearing in a dark sky, now

being lost to light pollution in many areas, immediately captures attention and evokes awe. As cities expand, the lack of personal contact with nature is producing negative psychological effects.2, 3 A planetarium's night sky is a powerful, memorable, and soothing image which encourages learning. Immersion sparks a viewer's creativity, interest, and engagement, aspects of Education's affective domain.

2) **Educational Standards:** Earth and Space Science and the scientific method are major themes in national and state pre-college educational standards. For example, countries require teaching the fact that patterns of the motion of the Sun, Moon, and stars in the sky can be observed, described, and predicted, and that seasonal patterns of sunrise and sunset be observed, described, and predicted. Both topics are best taught in a planetarium because of their ability to speed up time and show unobservable phenomena.
3) **Place for Inquiry-based Learning:** Inquiry-based learning is a teaching strategy and learning method that prioritizes student questions, ideas, and analyses. The planetarium environment triggers learner curiosity in ways that normal classrooms cannot. Students are able to discover sky changes that are parts of important long-term cycles, including day and night as a result of Earth's rotation, differences in the daytime paths of the Sun during different seasons, lunar phase and position changes during a month, and planet movement among the fixed stars. Acceleration of these sky changes, so that they occur in a convenient student-visit time period, provides exceptional opportunities for learning astronomy with inquiry procedures.
4) **Impacting Communities:** Planetariums are not just for young learners. They welcome everyone from the community to attend public events. Many community groups and professional organizations visit the Planetarium for lifelong learning experiences. Many STEM-related issues affect our planet today. It is the public who must have the capacity to understand these issues to make informed decisions and encourage powerful, global impact. Planetariums inform the public on these matters.
5) **Inspiration to Follow STEM and non-STEM Career Paths:** Astronomers, space scientists, and others working in STEM fields were influenced to follow their careers after planetarium visits. Currently, it is estimated that employment in the STEM field will increase by 1 million jobs by 2022 19. Also, the development of planetarium programming requires skills of computer programmers, writers, artists, animators, musicians, and others. These programs in turn inspire future writers, artists, and countless others.

3 Realizing the Vision and Mission of Universitas Muhammadiyah Surabaya Through the Planetarium as a Centre for Astronomy Education

Based on the Statute document of the University of Muhammadiyah Surabaya Year 2020–2025 [12] in Article 2 that the vision of UMSurabaya is

(1) UMSurabaya has a vision as a university that excels in the fields of morality, intellect and entrepreneurial spirit.
(2) The vision referred to in point (1) must be realized by 2025.

Meanwhile, the mission is contained in Article 3, which reads: To achieve the vision as referred to in Article 2, UMSurabaya has the following missions:

a. Organizing Education and learning that has the advantage of innovation and entrepreneurial spirit.
b. Organizing research and publications that contribute to science and technology and innovation.
c. Organizing research and innovation-based community service.
d. Acting as a centre for Muhammadiyah development and providing guidance and development for the academic community based on the values of Al-Islam and Muhammadiyah.
e. Organizing cooperation and governance with the principles of good governance.

In this section, we will discuss how the existence of the Planetarium as a centre for Astronomy education at UMSurabaya can encourage the realization of the vision and mission of UMSurabaya.

3.1 Astronomy in Education and Teaching at UMSurabaya

3.1.1 Astronomy Course in Islamic Family Law (Ahwal Syakhsiyyah) Study Program

Astronomy has officially become the name of a course in the Islamic Family Law (Ahwal Syakhsiyyah) study program at the Faculty of Islamic Religion since the odd semester of the 2021/2022 academic year. Astronomy is taught in odd semesters (semester 3) with the name Introduction to Astronomy and even semesters (semester 4) with the name Advanced Astronomy courses. This course is intended to support the science of Falaq as a feature of the study program. This is because in addition to astronomy-related to the main tasks and authorities of Religious Court Judges, also because the need for astronomy practitioners is very high, both by the general public and by experts in the field of Islamic law, especially in the Muhammadiyah Tarjih Council [13]. The studies in this course include the introduction of the universe and its scale, understanding and being able to observe the natural cycle of changes in appearance and movement patterns of Astronomical objects, especially the Sun; Month; Planets; and Constellations, initial understanding ideas about the sky such as calculating the size of the Earth, moon, sun and comparing their distances based on data from observations of astronomical phenomena such as shadows of the sun and eclipses.

3.1.2 Falaq Theory and Applied Falaq in the Islamic Family Law Study Program (Ahwal Syakhsiyyah)

Falaq studies the trajectories of celestial bodies. The movement or trajectory of these celestial bodies has a close relationship with the implementation of Muslim worship, such as determining the direction of the Qibla, prayer times, the beginning of the Qamariyah-month and lunar or solar eclipses. The study of astronomy intersects with the study of Falaq, for example, in Spherical astronomy or positional astronomy. Spherical astronomy is a branch of observational astronomy used to locate astronomical objects on the celestial

sphere, as seen at a particular date, time, and location on Earth, and on the mathematical methods of spherical geometry and the measurements of astrometry (The science of actually measuring positions of celestial objects in the sky).

3.1.3 Basic Natural Sciences, Earth and Universe Chapters

Basic Natural Sciences (IAD or Ilmu Alamiah Dasar) is one of the courses in the community life (MBB) subject group that must be given to university students as part of the core curriculum of study programs and applies nationally (Minister of National Education Decree No.232/U/2000). At UMSurabaya, IAD is a compulsory course for non-science study programs. The purpose of IAD lectures according to the Decree of the Director-General of Higher Education No. 30/DIKTI/Kep/2013, Article 3 states that the intended MBB competence is so that students master the ability to think rationally, have broad insight, have big souls as intellectual, civilized and dignified human beings who are responsible for the realization aesthetics, ethics and morals or cultural values for offspring, togetherness and welfare of community life, as well as the maintenance of natural resources and the environment. Armed with IAD, graduates are expected to think rationally, systematically and professionally in solving life's problems, be big-hearted and able to accept other people's opinions logically and scientifically, and have responsibility for natural resources and the environment [14].

Following the essence of the purpose of IAD lectures, mastery of concepts is no longer the focus of the objectives of IAD lectures. In IAD lectures, the development of thinking skills and positive values is prioritized; meanwhile, the concepts in IAD act as a 'vehicle' for developing these skills and values [14]. Study materials in basic natural sciences include the human mind and its development, the development of science and technology, the Earth and the universe, the biodiversity of living things and their distribution, natural resources and the environment, as well as the latest technological developments and their relation to environmental issues. One of the study materials in the IAD is the theme of Astronomy, namely Earth and the Universe.

For IAD lectures, critical thinking skills are a priority that must be developed, considering the characteristics of basic natural science itself as a science whose understanding is based on critical thinking skills. Basic natural sciences can be easily understood through ways of thinking based on a critical understanding of specific meanings, emphasizing connectedness, transformation, and quality to produce an acceptable result of analysis, reason, evidence, and theory.

3.1.4 Benefits of Planetarium in Astronomy Learning at UMSurabaya

As a subject or as a small part of a course, Astronomy is only available in five courses mentioned above, namely Introduction to Astronomy, Advanced Astronomy, *Falaq* Theory, Applied *Falaq*, and Basic Natural Sciences (IAD or Ilmu Alamiah Dasar). The existence of a Planetarium along with supporting facilities such as telescopes, celestial equipment will help in achieving competence, especially in material that requires abstraction of space, such as observing the natural cycle of changes in appearance and movement patterns of Astronomical objects, especially the Sun; Month; Planets; and the Constellations.

3.2 Astronomy Materials for AIK Course Learning

One of the characteristics of Education in Muhammadiyah is the combination of Islamic Education and general Education. In Muhammadiyah, Islamic education is represented by Al Islam and Kemuhammadiyahan (AIK) courses. AIK is an Islamic Religion Course that must be given to all students. Therefore, AIK has strategic value related to student character development. Currently, fresh ideas are needed in packaging AIK into evocative and enlightening courses [15].

AIK is a compulsory university course given to every student. This opportunity must be used properly to instil Islamic and Islamic values in students. What has happened so far is that AIK is often identified with Juzz Amma's memorization courses, memorization of the names of Muhammadiyah leaders, memorization of typical Muhammadiyah terms and the practice of praying according to Muhammadiyah understanding.

Efforts are needed to make AIK be a course characterizing authoritative, motivating, enlightening and always embedded in their lives. [15].

Al Islam and Kemuhammadiyahan (AIK) courses consist of four courses, namely AIK 1 (Humanity and Faith), AIK 2 (Worship, morality and Muamalah), AIK 3 (Kemuhammadiyahan) and AIK 4 (Islam, Science and Technology and Law).. We see the potential for using Astronomy as an enrichment material in AIK learning. For example, in learning Aqidah. We will find the truth and strengthen our belief about Allah SWT's existence and power by understanding nature. Compiling this Aqidah learning should include natural sciences such as astronomy, geography, and so on. So that at the end of each discussion, a study of monotheism is found, which is integrated with the natural sciences. This is the embodiment of a progressive education curriculum [16]. This is in line with the idea of Robert Aitken, director of the Lick Observatory, in his paper entitled The Use of Astronomy, saying that the use of Astronomy to give the man more knowledge about the universe and to help him learn humility and to know the greatness, that is the mission of astronomy [1].

Science and Technology are discussed specifically in IAK 4. Based on the AIK 4 Lecture Module at the University of Muhammadiyah Surabaya in 2020. The theme of the AIK 4 study consists of 6 modules, namely [17]:

Module 1: Monumental Works of Muslims in Science and Technology. Consisting of,
Module 2: Ethics of the Development and Application of Science and Technology in the view of Islam. Consisting of,
Module 3: Integration of Islam and Science
Module 3: Paradigm and Scope of Law in Islamic Perspective.
Module 5: Responsibilities of Muslim Scientists
Module 6: Faith, Science, Charity as pillars of civilization.

We see the potential for using Astronomy in learning the AIK 4 course, which contains the theme of Islam and science and Technology, especially in terms of Integration of Islam and Science. Learning Innovation is needed to answer the demands of developing AIK learning methods that are inspiring and enlightening.

The Qur'an recommends Muslims not to discriminate between knowledge because all knowledge is from Allah. Among the terms of the Koran that have a close relationship

with the theme of the integration of Islam with science is the call for people to think. In dozens of verses, both Makiyah and Madaniyah letters, the Qur'an invites to think or use the mind in understanding the various creations of God that lie on this earth [17]. The verses in the Qur'an use a lot of astronomical objects and phenomena to call people to think. Giving students the experience of seeing a simulation of Astronomical phenomena, which begins with understanding the related verses of the Koran can be an AIK learning approach that integrates Islam and Science.

3.3 Research Potential Based on Astronomy Education at the Planetarium

Since that first planetarium installation nearly 100 years ago, researchers in Education have grappled with understanding how people learn in the Planetarium. Scholarly efforts to quantify just how much learning occurs in the Planetarium. The first published peer-reviewed literature review of planetarium education was compiled and evaluated by Smith (1974). Considered to be highly comprehensive for its generation, more than 100 literature sources were included in Smith's scholarly review.

Smith divided the field into three categories of works: descriptive, comparative, and curriculum studies. Descriptive studies were considered to be those that "attempted to describe the status of planetarium operations at various stages of development." Comparative studies were empirical comparisons of the effectiveness of classroom and Planetarium, typically with astronomical learning concepts. Curriculum studies focused on which grade levels have the best time to teach particular astronomical concepts within the Planetarium. Smith synthesized the field exceptionally and gave planetarium education researchers direction for future studies.

Fifteen years later, Riordan (1991) reviewed planetarium education projects such as classroom projects, Planetarium, and participatory lessons and focused research. He divided the literature based on learning theory, classroom/planetarium research, participatory oriented research, focused and other research. Two years later, Hunt (1993) reviewed research of visuals and media from educators and extrapolated them into a planetarium setting. Specifically, he reviewed the visual literacy research, cueing techniques, audiovisual research, and facility goals and objectives. Hunt was highly selective with the types of articles he reviewed in that he constricted his analysis to works related to visuals and media within the Planetarium. He described each study in an annotated bibliography format and inferred how those studies' results could be transposed or tested in a planetarium setting. Hunts work is notable for giving the planetarium research community explicit direction. It is also notable for using studies that have already been conducted and standing on the shoulders of giants, rather than treating learning with media as an isolated island of research.

Nearly twenty years after Hunt's analysis, Brazell (2009) reviewed "Planetarium Instructional Efficacy: A research synthesis" for his doctoral dissertation at Texas A&M University. He considered the statistical effect sizes concerning student achievement and student attitudes, which highly constrained which studies he could use for analysis. Brazell's dissertation used standard practice, quantitative meta-analysis methods emphasized a selective group of planetarium education research articles related particularly to planetarium efficacy. 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. 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.

Other research outside of Astronomy education but based on Planetarium, for example, on planetarium architecture and the social and economic impact of Planetariumrium. In summary, the benefits of educational research and other research at the Planetarium for UMSurabaya, namely:

1. University performance through lecturer research results in quantity and quality.
2. Development of learning for astronomy courses in particular and in general for science courses and AIK at UMSurabaya.
3. Contribute and make recommendations on education priorities and policies for PP Muhammadiyah and the Government of Indonesia.
4. Considerations for funders and investors for continued support for Planetariumrium.

3.4 Enlightening UMSurabaya Students, Muhammadiyah School Students, Muhammadiyah Cadres and the General Public with Scientific Literacy Through Astronomy Education at the Planetarium

Today science and technology are experiencing extraordinary developments. The world has reached the 5.0 revolution stage. Ideally, this rapid development is in line with public interest and knowledge of science. This condition causes the need for a scientifically literate society. Developed countries invest heavily in scientific literacy activities for their citizens. Scientific literacy is the ability to identify, understand and interpret issues related to science that is needed by someone to make decisions based on scientific evidence. Scientific literacy is the main goal of science education [18]. The welfare of human life is the main goal of applying science and science. Scientific literacy equips humans with intelligence to better understand themselves and their environment to achieve prosperity in life [19]. Another definition of scientific literacy is the ability to engage with issues related to science, this does not mean that one knows more things but is determined by how one makes decisions based on scientific understanding [20].

As the world has become more and more technologically oriented, it has become ever more clear that our society needs not only well-trained scientists and engineers, but also workers who are knowledgeable to undertake a wide variety of jobs requiring some basic understanding of science and technology without becoming professionals in those fields, and a generally scientifically literate population as well [21].

Astronomy, along with its object of study, is a science with universal appeal. Likewise, the Planetarium with its unique shape, as well as supported by technological facilities, has a great magnet to attract the general public to know and understand science and its processes. Around the world, comet trips, meteor showers, eclipses, and star parties on clear nights are almost always successful public events complemented by performances under the dome of the Planetarium. The Planetarium, along with other supporting facilities and activities, will increase the scientific literacy of the Indonesian people.

Community service activities at the Planetarium are not only a one-way pattern but can also be a two-way pattern. Visitors who come from various backgrounds such as

students, university students and the general public can empower themselves to become amateur astronomers and join an astronomy club based at the Planetarium. For decades, many planetariums were the reference point where young, and adult amateur astronomers would meet regularly, find out about the latest news and discoveries from space exploration programs, and have direct access to the experts. The visit to the Planetarium with the school or a public event was a major highlight of the year, or perhaps a few times a year if the distance allowed it. Many astronomy clubs and societies originated in and around planetariums and, in a perfect symbiosis, drew regular audiences to the Planetarium from their membership, while first-time visitors to the shows would have the opportunity to pursue a new hobby by joining the clubs and societies.

This condition allows for a community to grow organically out of these institutions, with an enriching generational mix made of the astronomers who run the planetariums, retired scholars volunteering their expertise, adult amateurs, students, and young kids all being able to share their passion and learn from each other. Is this not the dream of any modern public engagement initiative? Planetariums have been exemplary for all areas of science and technology in the way that they opened up the famous "ivory towers" where scientists were said to hide from society.

Based on the points of the explanation above, the Planetarium and other supporting facilities can become a center for Astronomy education which will become a means of community service based on research and innovation as the UMSurabaya mission.

4 Conclusion

Planetarium will support mainly on learning Astronomy to brighten all students to literate science. In addition, we mention the significance of astronomy as a part of the integration of science and Islam in the Al-Islam and Kemuhammadiayan course. We also point out the economic opportunities and benefits of Planetarium in the UMSurabaya.

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