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Hotstar: Holographic of Astronomical Objects

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Abstract

In order to answer the world's challenges related to the development of science from generation to generation, this study discusses the introduction of astronomy as one of the disciplines that affects several aspects of life, such as in the calculation of the time of worship of religious people (Islam), the determination of time in each region in various parts of the world, and so on, which in this case is juxtaposed with the pace of technological progress along with the development of the world. is increasing. In the content of the discussion related to astronomical orientation, the researcher also included the history of the development of astronomy along with previous Muslim astronomers with their various discoveries. This research also frames a series of astronomical introductions through technology in the form of simple holograms used to visualize astronomical objects. By using a qualitative research method conceptualized through the trial of visual-interactive products in the form of simple holography-based props, *Hotstar* is designed to orient the field of astronomy science to the general public with simple hologram visualization. The final results of the trial stated that 90% of respondents were satisfied with *the Hotstar* teaching aids and this research will also continue to be developed to increase interactivity in material exposure and astronomical orientation in the future.

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A. Introduction

According to the linguistic meaning, astronomy itself comes from the Greek language, namely *astronomy, 'astron'* which means star and *'nomos'* which means law, so it means that astronomy is the science of starry or astronomy that studies celestial bodies and natural phenomena that occur outside the Earth, including phenomena in the upper atmosphere of the Earth that come from space. Meanwhile, according to a study from the Bandung Institute of Technology, which *incidentally* is the only campus that owns an astronomy study program in Indonesia, explained that astronomy generally uses mathematical and physical sciences to observe, analyze, and visualize celestial bodies so that

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they can be understood the origins, physical or chemical properties, meteorology, motion of celestial bodies, and explanations related to the development of the universe. Some astronomical theories that are widely known by the wider community such as the heliocentric theory, the BigBang theory, and the geocentric theory.

Research related to astronomy is now not only carried out by scientists and experts, but also begins to attract the attention of increasing insight by students and students as the young generation of the millennial era and Muslim scientists of the world. One of the astronomy experts at the Bandung Institute of Technology, Hakim Luthfi Malasan, revealed that although there is no complete astronomy content in the school curriculum, students can know and learn astronomy from other reliable sources as well as looking at astronomy in research, educational activities, and even from the entrepreneurial aspect.

Many practitioners say that astronomy is a branch of Islamic science that has a special position because of its role which is so significant in worship. Like the Islamic astronomical figure, Al-Khawarizmi. Beiau, who has contributed with the construction of his astronomical-mathematical thinking, made it as the foundation for the development of Islamic astronomy, in addition to the development of geocentric theories of two famous scientists, Aristotle and Ptolemy, which later became the starting point for the development of Muslim science and astronomy with the emergence of various observatories and planetariums for observation with various more modern tools and gave birth to new theories in the world astronomical studies [6]. Also there is Az-Zarqali, a Muslim scientist from Spain who was famous in the 11th century. The astronomer, whose full name is Abu Ishaq Ibrahim Ibn Yahya Az-Zarqali, has been known as an expert in star observation and measurement who was previously a metal mechanic with many amazing works, although history states that he never had a formal education at all. One of Az-Zarqali's most famous inventions is an advanced *astrolabe* called Safiha, an astronomical analogue computing device that is generally used as a multifunctional instrument to predict, simulate, navigate, measure, and calculate the position and dynamics of celestial bodies but with greater simplicity and accuracy. In addition, one of the masterpieces created by a team of Muslim and Jewish scientists formed by Said Al-Andalusi is the Table of Toledo which was later perfected by Az-Zarqali in 1080 and universally recognized by European society two centuries later. In

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addition to the *astrolabe* that he created with a higher level of complexity as well as a work of discovery Az-Zarqali is most famous, there is also the theory of the ecliptic and the table of 29 stars that the Andalus scientist has created.

Allah Swt. often explains in the Qur'an the creation of the universe, including the heavens and the universe and its contents. One of them is as stated in QS. Al-An'am / 06 : 96 – 97 as follows:

96. " [He is] the cleaver of daybreak and has made the night for rest and the sun and moon for calculation. That is the determination of the Exalted in Might, the Knowing. 97. And it is He who placed for you the stars that you may be guided by them through the darknesses of the land and sea. We have detailed the signs for a people who know ."

In *Tafsir Al-Mishbah*, it is explained related to these two verses that Allah SWT created the sun, moon, and stars to be a calculation for human beings who think and are devout. Just as the morning dawns so that His creatures can move and move freely, so does the darkness of the night for rest. It is the same with the stars who are the guides for His creatures. The existence of constellations can be a calculation of the direction you want to go. These things prove that everything created in the heavens and earth is according to the will and decree of Allah Swt. [7]

It is also mentioned that related to the heliocentric theory, there are several verses that explain the movement of the sun, moon, earth, and objects other skies such as QS. Yunus : 5, Yasin : 38, An-Naml : 88. In addition, it has also been mentioned by another Muslim inventor regarding things that have become the decree of astrologers today related to theories in the Qur'an such as astronomy in the proof of Allah's power, namely with the alternation of day and night, the essential motion of the sun, the apparent motion of the sun, and so on [2].

On the other hand, the insight-hungry human generation often conducts research to improve the ease of human survival as well as world civilization. As well as technological developments that are accelerating rapidly from time to time. One form of technological development that is now quite attractive to the public is holograms. The word hologram itself consists of the Greek term *"holos"* which means "to see the whole" and *"gram"* which means

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"written" where hologram is a product of holography technology as the incarnation of cutting-edge *information storage* [4]. Holography is a technique that allows the light from a scattered object to be recorded and then reconstructed so that the object seems to be located in a reactive position equal to the recording medium. The object that then appears in 3D using pure light is a hologram. As explained on the official website of the Padang University Library, holograms are formed from a combination of two coherent light rays and in microscopic form as a repository of optical information which will then form an image, scene, or scene [1].

Currently, the use of 3D animation is increasingly popular along with the improvement in quality from the implementation of technological advances, one of which is 3D rendering which is a two-dimensional representation of the *wireframe model* on the computer by providing several options such as textures, colors, and materials. One of the *open source software* in 3D computer graphics is *Blender* which is used as an animation maker, visual effects, interactive 3D applications, and the like [5].

The products of technological developments are also not spared from their connection with the discussion in the Qur'an where Allah said:

80. "And We taught him the fashioning of coats of armor to protect you from your [enemy in] battle. So will you then be grateful? 81. And to Solomon [We subjected] the wind, blowing forcefully, proceeding by his command toward the land which We had blessed. And We are ever, of all things, Knowing".

From the Tafsir Al-Mishbah, it is stated that Allah gives understanding to human beings as a gift to be thankful where the depth of a person's understanding will affect his behavior in daily life because the Qur'an has hinted that the ability to apply science can create benefits and deny harm or harm [7].

Some of the research that has been carried out related to the integration of the concept of holograms in the introduction of astronomy includes an article by Anne Buckner entitled "*A HOLOtta Fun: Explaining Astronomy with 3D Holograms*". It is also mentioned that astronomy education through the mechanism of astronomical literacy can be used as a driving force Increasing human capacity in the field of science and technology, which is further astronomy literacy, can be one of the important means to support the development of

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students' knowledge and thinking skills (Buckner, 2019). Discipline in astronomy has also given rise to a variety of new questions and innovations related to the mysteries of the universe, especially the use of "Data-Intensive Astronomy" as the next strategy in orienting astronomy education which finally a strong 'Science Platform' can be built to support applied science and other technological developments that lead to the ultimate goal of building innovation (Soonthornthum, 2019).

From some of the previous studies above related to the introduction of astronomy and the development of the hologram concept, the researcher seeks to create innovations from the results of the integration of the hologram concept to visualize several materials in astronomy in the form of a simple hologram demonstration called "*Hotstar*". The tool will later be a demonstration of object recognition in astronomy material as well as testing the effectiveness of the integration of the hologram concept used in the orientation of astronomy with respondent satisfaction parameters.

B. Method

This study uses qualitative research with an evaluative method on products created from field case study innovations. Qualitative research itself is research that focuses on emphasizing processes and meanings that are not accurately measured with descriptive data. Therefore, the effort to realize *Hotstar* in this study also uses qualitative research with parameters in the form of the enthusiasm of the respondents who has conducted a trial on *Hotstar products*. As for the effectiveness of the research results, it will be obtained from the results of the satisfaction questionnaire distributed to respondents after conducting a trial on *Hotstar*.

Some of the research instruments used in this study are *Hotstar* as a simple hologram demonstrator to visualize objects in basic astronomy material and *Hotstar effectiveness questionnaire* as an object visualization demonstrator in astronomical materials. As for the research indicators, the place was held at Bayt Al-Hikmah High School, Pasuruan City on Tuesday, January 2, 2024 with a total number of respondents, namely 30 students from representatives of classes X, XI, and XII of Bayt Al-Hikmah High School.

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C. Results and Discussion

1. Introduction to Basic Materials in Astronomy

Some of the basic astronomy materials in *Hotstar* visualization include:

a. *History of Astronomy*

b. *Basic Material* [Mapping Basic Astronomical Matter]

- Cosmology, Stars, and Galaxies Theory
- Instruments and Calculations in Astronomy
- Phenomena and Objects in Astronomy

c. *Fun Fact!* [Collection of Interesting Facts Related to Astronomy]

2. The Use of Holography Concepts Based on Light Reflection Reconstruction in the Making *of Hotstar Teaching Aids*

The model for making *sans holograms* for 3D hologram physical props with materials, namely transparent *glass* placed on a *cardboard assembly* according to the provisions. Some of the cardboard sizes used to assemble *Hotstar props* are; 7 cm x 21 cm as many as 2 pieces, 7 2 cm x 25 cm, 22 cm x 25 cm 1 piece, 22 cm x 11 cm 1 piece, and 22 cm x 10 cm 1 piece. All pieces of *cardboard* and *transparent glass* are assembled according to the size and provisions.

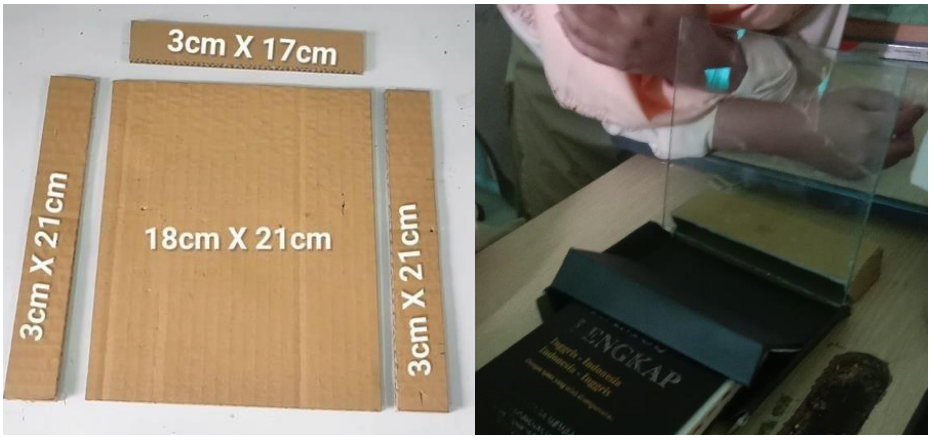

Figure 1. Video Creation of 3D Astronomical Materials and Objects

3. In the creation of 3D material videos and holograms that will briefly and interactively visualize theories and objects in basic astronomy, namely through *Canva* and *the Blender* 4.0 application.

a. Canva Website

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Canva is anonline graphic design tool that uses *drag and drop* techniques while being able to access other features such as *fonts*, images, shapes, and others (Isnaini et al., 2021). In the production of *Hotstar* astronomy material videos, 10 *visual design* slides were used with *export* results in the form of video presentations of materials such as an introduction to the history of astronomy, mapping of basic astronomy materials, and interesting facts related to various phenomena that occur in the scope of astronomy.

b. Blender 4.0 *Application*:

Figure 2. Hotstar 3D animation and visual design creation on *Blender 4.0*

The Blender *application* is an asset builder application that is a *moving-animation illustration* to create 3D animations of astronomical objects such as the Earth, Sun, Moon, cosmic light beams, and others. In the creation of Hotstar 3D animation, visual design programming in the form of astronomical object textures and rotation patterns produces *output* in the form of 3D animation videos in 3D format Studio.3ds.

4. Effectiveness of Research Results

a. Hotstar Theoretical Video *Viewing*

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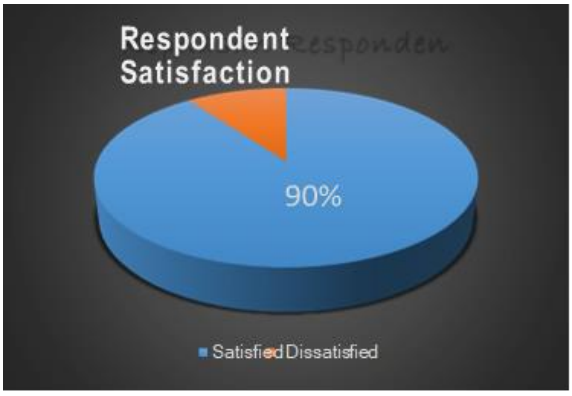
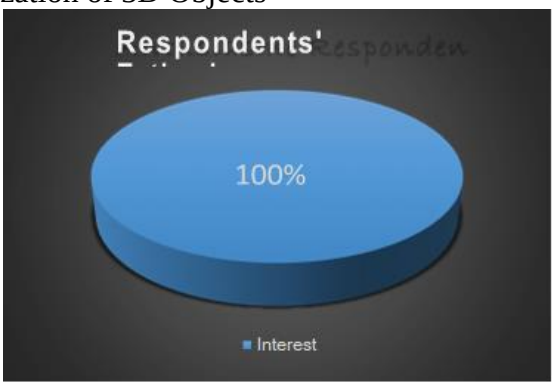


Graph 1. Hotstar *Theoretical Video Presentation Satisfaction Percentage*

From the graph above, it can be concluded that out of 10 questionnaires given to respondents, there are 10% of respondents who stated that they were not satisfied with the video presentation of basic astronomy material.

b. *Hotstar* Visualization of 3D Objects



Graph 2. Percentage of Respondents' Enthusiasm for *Hotstar 3D Visualizer*

The graph above shows the percentage of enthusiasm of all respondents 100% which in other words all respondents feel interested and enthusiastic about the visualization of astronomical objects through the concept of simple holograms used in *Hotstar*.

c. Respondent's Comments

Some of the criticisms and suggestions given by respondents to the *Hotstar* device include changing video *slides* that are too fast, the limitations of the function of Hotstar's teaching aids, and the duration of Hotstar's 3D video materials and animations is not appropriate. For satisfaction and interest, ± 90% of respondents are very enthusiastic about *Hotstar warat*.

D. Conclusion

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Drawing a common thread from the above research, it can be concluded that the innovation of astronomy orientation with simple hologram visualization in the form of *Hotstar props* is enough to attract the attention of students of Bayt Al-Hikmah High School. Approximately 90% of the total respondents feel enthusiastic and interested in *Hotstar*'s innovations, which can be a spur for researchers to be able to carry out sustainable development of *Hotstar* because there are still many limitations and minimization of functions and effectiveness values that are still less than initial expectations.

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