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Strengthening Spiritual Values through Environmental Physics Learning Assisted by Authentic Data Modelling and Visual Media

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ABSTRACT

Environmental Physics concepts are very likely to be explored to facilitate the cultivation of spiritual attitudes because they are closely related to phenomena in everyday life. Visual media can help visualize environmental phenomena so that they are easier to understand. This study aims to instill spiritual values through the concept of Environmental Physics as an alternative learning that focuses on the affective domain with the help of visual media. This study involved 15 science education postgraduate students. This research used a Pre-experimental design with a Shoot Case Study. The research design includes pre-experiment, experiment, and analysis of experimental data results. In the pre-experiment stage, the concept of environmental physics and spiritual attitudes were analyzed, learning tools were prepared, and questionnaire instruments for student perceptions related to the cultivation of spiritual values were prepared. At the experimental stage, the implementation of Environmental Physics learning integrated with spiritual values was carried out. In the post-experiment stage, data analysis and interpretation were carried out to answer research problems. Based on the results of data analysis, it is known that 92.15% of respondents strongly agree that learning environmental physics can instill awareness of the nature of God. Based on the results of the open-ended questionnaire, it is known that students can explain the content of spiritual values in various phenomena in the environment. In addition, students stated that visual media can facilitate the activity of instilling awareness that God is omnipotent over all the universe. Thus it can be concluded that environmental physics learning activities can instil spiritual attitudes through environmental physics content assisted by visual media. Science content, especially environmental physics, is very relevant in instilling spiritual values.

INTRODUCTION

Integrating spiritual values into education is crucial for developing graduates who are not only productive, creative, and innovative, but also guided by strong ethical principles (Lubis & Darmana, 2024). To achieve this, learning outcomes are usually broken down into key areas: spiritual attitudes, social attitudes, knowledge, and skills (Fraser-Pearce, 2022). Educators must seamlessly integrate these competencies into their teaching practices (Harlos, 2000). In

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science education, particularly in physics, learning experiences should aim to cultivate students' social and spiritual awareness. By doing so, students form a stronger bond with the natural world, which contributes to their spiritual growth (Mulyasa, 2013).

When taught with a spiritual perspective, environmental physics concepts can help increase awareness of the universe's creator and remind us of our responsibility to care for nature and all living things (Wickström, 2012). Environmental physics concepts discuss natural phenomena that are close to human life (Husamah et al., 2022). These phenomena have an impact on human life. For example, the concept of environmental physics about the seasons and the hydrological cycle. The water cycle provides benefits where the availability of water is always there and continues to cycle to eventually become rainwater that returns to the earth (Santyasa et al., 2017). Rain clouds don't just stay where water vapor is produced—they are carried by the wind so that rain can fall across different parts of the earth, reflecting God's mercy. The changing seasons also bring harmony to the environment. In the tropics, for instance, the rainy season is balanced by the dry season, showing how God maintains balance and order. This serves as a reminder that God's greatness is meant for the well-being of humanity, and we should treat the natural world with care and wisdom.

Processes in nature that involve physics concepts, some of which are invisible to the eye, include things like the evaporation stage in the hydrological cycle (Günay et al., 2017) since clouds and vertical temperature differences can't be seen directly, visual media is needed to observe them. Concepts that aren't easily visible can often lead to misunderstandings (Jolley et al., 2012; Miller & Brewer, 2010; Rosnita, 2016). Visual media, such as animations, can make it easier to grasp physics concepts related to natural phenomena. This, in turn, can deepen spiritual values. Animations are often used in teaching to enhance understanding (Bezen et al., 2016). The use of various technologies including visualization media in learning activities can help to achieve a comprehensive understanding (Santos & Arroio, 2016).

A preliminary study surveyed 116 respondents from 8 universities in Indonesia and found that environmental physics concepts have the potential to foster spiritual values. Over 90% of respondents believed that physics can explain various natural phenomena in daily life, such as floods and landslides, which serve as reminders of God's power. Additionally, 90.5% of participants agreed that incorporating spiritual values into physics education is crucial to counter the decline of moral values. These findings suggest that teaching environmental physics, particularly about natural phenomena, can effectively promote spiritual growth through science learning.

This is relevant to the statement McConnell & Kraft (2011) that the concept of the earth has very potential to be directed at the attitudinal aspects of developing student learning. Research conducted Duncan & Arthur (2012) revealed that astronomy lectures with a curriculum equipped with thinking and reasoning activities influence attitudes. This is also relevant to research conducted by Torres (2009) revealed that a person's virtual attitude influences the understanding of astronomical concepts. This indicates that space concepts that are very difficult to observe directly and need in-depth reasoning to understand affect are influenced by a person's spiritual attitude. Natural phenomena explained with physics concepts and using visual media and modeling authentic earth data can facilitate the cultivation of spiritual values related to the nature of God (Johan et al., 2017).

The statement above shows that developing students' critical thinking and nurturing their spiritual values are both crucial. As we know, advances in technology often coincide with a decline in moral and ethical standards. This aligns with

earlier research that indicates a general decline in morals in society (Hookway, 2014; Ten, 2018). Morals and ethics are also closely related to spiritual and religious values. Therefore, it is necessary to design learning programs that can instill spiritual attitudes in the learning process. It is in the context of this research that the intersection of science and religion becomes very possible. Science is very likely not to be value-free (Karwadi, 2008). Science concepts including environmental physics are very likely to be explored to facilitate the cultivation of spiritual attitudes in learning activities. The benefits of embedding spiritual attitudes in learning can be an important stage in shaping the spiritual character of student teachers and prospective teachers.

Previous research on strengthening spiritual values through physics learning has been carried out, for example on the concept of measurement (Bachtiar et al., 2024) on force concept material (Rusydiana, 2024), interactive modules on solar system material (Sholikhah et al., 2024), teaching materials for character education (Kamus et al., 2020), teaching materials for conceptual understanding (Rukmana et al., 2022), and teaching materials integrated with intelligence content (Septian et al., 2019). To the best of the researchers' knowledge, there hasn't been any research that focuses on enhancing spiritual values through physics education, particularly environmental physics, using authentic data modeling and visual media.

This research lays a strong foundation for fostering other spiritual qualities needed to develop good spiritual character. It also highlights the connection between science and religious values. Therefore, this study is essential in reinforcing students' spiritual values through environmental physics, supported by visual media. Not only can it help improve their thinking skills during the learning process, but it can also enhance their spiritual attitudes through the use of visual media.

METHODS

The methods used should be accompanied by references, relevant modifications, data analysis procedures and techniques, and research flow, and should be emphasized in the literature review article.

This research was conducted in one of the public LPTKs in Bengkulu city which organizes the Master of Science Education Study Program. The research was conducted using a Pre – experimental design with a Shoot Case Study. The research design includes pre-experiment, experiment, and analysis of experimental data results. The research design can be seen in Table 1.

Table 1. Design experiment class

Class	Pre-Experiment	Implementation	Post Experiment
Experiment	O	X	T

Notes:
O: No test given
X: Treatment in the experimental class with the cultivation of spiritual attitudes through environmental physics science learning assisted by visualization media and visualization of authentic data models analyzed using GrADS software.
T: Final test

In detail, the flow of research conducted in the experimental class can be seen in the Figure 1.

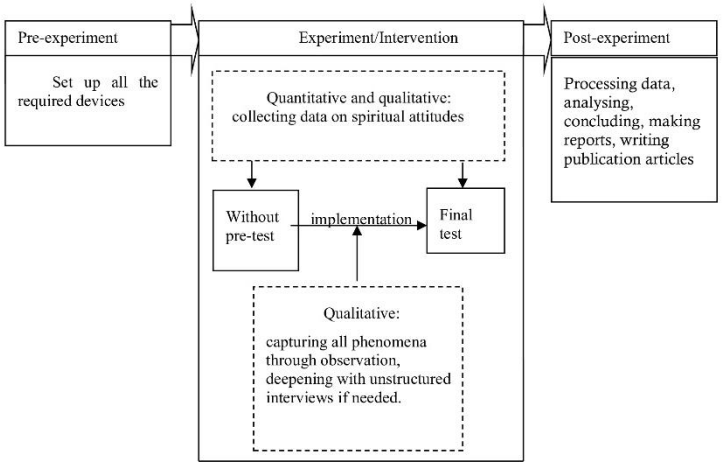


Figure 1. Research design

At the pre-experiment stage, the concepts of science, especially environmental science, and the potential of spiritual values that can be embedded in learning are analyzed, and all learning tools, media, and data collection instruments are developed. Then enter the next stage, namely the experimental stage. At the experimental stage, classroom implementation and data collection were carried out. In the post-experiment stage, processing data, analyzing, concluding, making reports, and writing publication articles. This research will be conducted at Bengkulu University, S2 Science Education Study Program. This study involved 15 science education graduate students who took environmental physics courses.

Data related to strengthening spiritual values in learning environmental physics was collected through questionnaires. Three different types of questionnaire instruments were used to capture data on student perceptions related to strengthening spiritual values through environmental physics content. The questionnaire instruments developed were an attitude scale questionnaire, a semantic differentiation questionnaire, and open-ended questions. Daily notes were collected based on observations of learning activities. The five types of questionnaires use the same indicators. The spiritual value indicator used in this study is the value of Godhead related to belief in God, namely:

1. Realizing God's nature as the most gracious,
2. Realizing God's attributes as the all-governing,
3. Realizing God's attributes as the most sustaining,
4. Realizing God's nature as the all-considering,
5. Realizing God's nature as the most balanced,
6. Realizing God's nature as the giver of mercy,
7. Realizing the reason for the need to be wise towards nature, and
8. Realizing the reason for the need to be grateful to God.

Learning activities are conducted using the Interactive Conceptual Interaction (ICI) approach. There are four features used in learning activities, namely concept focus, using text, research-based material, and classroom interaction. In detail, the activities in each feature of the ICI approach used can be seen in Table 2.

Table 2. Learning Activities Using the ICI Approach

Concept focus: Students are taught concepts with the help of visual media. Visual media is used to facilitate understanding of environmental physics concepts through various natural phenomena. Visual media is expected to be able to visualise invisible physics concepts related to phenomena in the environment. In learning activities, spiritual values are inserted through various environmental phenomena discussed in the learning activities.	**Classroom interaction:** During the learning activities of environmental physics, there are interaction discussions between students with students, students with lecturers, students with learning resources.
Using text: Students are directed to be able to find key words from various cases and various text narratives used in environmental physics learning activities.	
Research based material: Visualisations derived from the results of authentic data analysis derived from satellite data modelled using GrADS (Gradient Analysis and Display System) software relevant to environmental physics concepts.	

Data on perceptions of the cultivation of spiritual attitudes through environmental physics learning were analyzed qualitatively. Each indicator was calculated as the percentage of response. In the open-ended questionnaire, a recapitulation was made based on the keywords of each student's answer. The results are then interpreted.

RESULTS AND DISCUSSION

Result

Environmental physics learning activities that have been carried out focus on spiritual attitudes in addition to focusing on cognitive aspects. This article specifically discusses strengthening spiritual values with the help of visual media and the visualization of the results of authentic data modeling analysis using GrADS software. Learning activities are carried out following the features of the Interactive conceptual Interaction (ICI) approach. Data on strengthening spiritual values in environmental physics learning activities can be seen in Table 3.

Table 3. Spiritual attitude data through attitude scale questionnaire

No	Spiritual attitude indicators	Response (%)			
		STS	TS	S	SS
1	Environmental physics learning that has been done strengthens awareness of God's nature as the most gracious.	100	0	0	0
2	The learning of environmental physics that has been done strengthens the awareness of God's nature as the ultimate organiser.	90,9	9,1	0	0
3	The learning of environmental physics that has been done strengthens the awareness of God's nature as all-preserving.	90,9	9,1	0	0
4	The learning of environmental physics that has been done strengthens the awareness of God's nature as all-consuming.	90,9	9,1	0	0
5	The learning of environmental physics that has been done strengthens the awareness of God's nature as a balancing force.	91,8	8,2	0	0
6	Learning environmental physics that has been done strengthens awareness of God's nature as a giver of grace.	90,9	9,1	0	0
7	The environmental physics learning that has been done strengthens awareness of the reasons for the need to be wise towards nature	90,9	9,1	0	0

No	Spiritual attitude indicators	Response (%)			
		STS	TS	S	SS
8	The environmental physics lessons learnt strengthened awareness of the reasons for being grateful to God.	90,9	9,1	0	0
	Total Responses	92,15	7,85	0	0

Based on the data in Table 3, it is known that more than 90% of the total respondents strongly agreed that learning environmental physics with the help of visual media and visualization of authentic data modeling results using GrADS software that has been done strengthens awareness of beliefs like God, the nature of God as the most gracious, the most regulating, the most nurturing, the most calculating of all things, the most balancing and the most gracious. 90.9% of the total respondents strongly agreed that learning environmental physics has strengthened awareness of the reasons for the need to be wise towards nature. 90.9% of the total respondents also strongly agreed that learning environmental physics that has been done strengthens awareness of the reasons for the need to be grateful to God. In addition to using an attitude scale questionnaire, student responses related to the fact that learning activities related to strengthening spiritual values through environmental physics learning have been captured using a semantic differentiation questionnaire. Data on the results of student responses can be seen in Table 4.

Table 4. Spiritual attitude data through attitude scale questionnaire

No	Spiritual attitude indicators	Response			
		SS	S	J	TP
1	I feel that the environmental physics lectures that have been conducted have led me to realize God's nature as the most gracious.	100	0	0	0
2	I feel that the environmental physics lectures that have been conducted have led me to increasingly realize God's nature as a supreme organizer.	100	0	0	0
3	I feel that the environmental physics lectures that have been conducted have led me to realize more and more the nature of God as the one who maintains the environment.	90,9	9,1	0	0
4	I feel that the environmental physics lectures that have been conducted have led me to realize God's nature as the all-considering God.	90,9	9,1	0	0
5	I feel that the environmental physics lectures that have been conducted have led me to realize God's nature as the ultimate balancer.	100	0	0	0
6	I feel that the environmental physics lectures that have been conducted have led me to realize God's nature as the giver of grace.	100	0	0	0
7	I feel that the environmental physics lectures that have been conducted have led me to become more aware of the reasons for the need to be wise towards nature.	90,9	9,1	0	0
8	I feel that the environmental physics lectures that I have done have led me to realize more and more the reasons why I need to be grateful to God.	90,9	9,1	0	0
	Total Responses	95,45	4,55	0	0

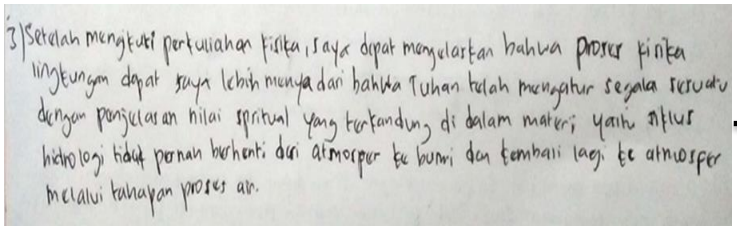
Based on the data in Table 4, it is known that 100% of the total respondents stated that they felt that in environmental physics learning activities lecturers often directed them to increasingly realize that God is the bestower of mercy, balancing, managing, and gracious through various natural phenomena in environmental physics. 90.9% of the total respondents stated that lecturers very often direct the learning of environmental physics through various natural phenomena to be more aware that

God is all-preserving and calculating everything, directing to be wiser towards nature and more grateful for God's blessings.

Strengthening spiritual values carried out in learning environmental physics through the insertion of divine values in various phenomena in the environment is also reflected in student responses through open-ended questions questionnaires. In general, based on the results of the analysis of student responses, it is known that:

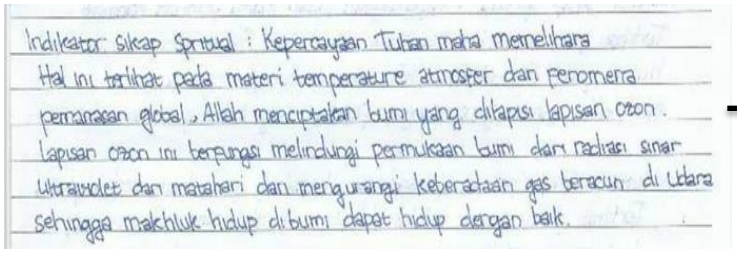
1. Students stated that various environmental phenomena can be explained by physics concepts.
2. Various natural phenomena in our environment greatly illustrate the greatness of God so that it leads to the further realization of the properties of the Godhead.
3. Learning activities that insert the value of divinity through natural phenomena in the environment are very helpful in strengthening spiritual values and attitudes.
4. Visual media is very helpful in understanding various natural phenomena in the concept of environmental physics
5. Visual media can help understand the interrelationship of natural physics concepts explaining the process of natural phenomena that cannot be observed with the naked eye so that it better illustrates God's power through various invisible natural phenomena
6. Visualization of authentic data modeling facilitates knowing the real condition of the environment, helping to better understand the content of environmental physics 6.

A snapshot of student responses to the open-ended questionnaire can be seen in Figure 2.



a

After attending physics lectures, I can conclude that the process of environmental physics has helped me realize that God has meticulously arranged everything. This is evident from the spiritual values embedded in the material, specifically that the hydrological cycle never ceases from the atmosphere to the earth and back again to the atmosphere through continuous processes.



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Spiritual Attitude Indicator: Belief that God is the one who sustains life.
This can be seen in the material on atmospheric temperature and global warming phenomena. God created the earth, which is covered by the ozone layer. This ozone layer functions to protect the earth's surface from the sun's ultraviolet radiation and to prevent the presence of toxic gases in the atmosphere, allowing living beings on earth to live well.

Figure 2. Excerpts of student responses to the open-ended questions questionnaire, (a). student responses related to strengthening the value of divinity that God can regulate everything through the phenomenon of the hydrological cycle; (b). student responses related to strengthening the value of divinity that God can maintain everything through the ozone layer in the phenomenon of global warming.

In Figure 2, it is known that students state that the concept of environmental physics related to various natural phenomena has a message of spiritual value related to the nature of God. Students can provide examples of natural phenomena that are relevant to the concept of environmental physics and the spiritual values contained therein.

Discussion

Based on the research data, it is known that an average of 92.15% of the total respondents gave statements strongly agreeing that environmental physics learning activities strengthen spiritual values. These results indicate that science content, especially environmental physics, can be directed towards achieving the attitudinal domain, especially spiritual and religious attitudes as mandated in the K13 curriculum and in the general description of KKNI. This success can be seen from the response of postgraduate students involved in environmental physics learning activities. Students stated that environmental physics learning activities that have been carried out provide treatment with a very frequent frequency in inserting spiritual values through natural phenomena discussed in environmental physics Relevant to (Johan et al., 2021) which states that the concept of earth magnetism in earth and space science learning contains the spiritual value that God is all-preserving and protecting His creatures.

Strengthening spiritual values in environmental physics learning activities that have been carried out is thought to be influenced by each activity in the features of the ICI approach used. At the concept focus stage, students are given insight and instilled concepts related to environmental physics. Natural phenomena related to the environment are presented with the help of various visual media such as images and animations. The use of visual media can help to understand concepts such as using sketches, visualizations, and virtual animations (Kali, 2003; Prain et al., 2009; Smith & Bermea, 2012). Visual media used in learning activities facilitates students to understand the concept of environmental physics because they can understand the processes that occur in invisible environmental phenomena. An in-depth understanding of the linkages between scientific independence, technology, and pro-environmental behavior is necessary for students (Bezen et al., 2016; Kastens, 2010; Santos & Arroio, 2016). One example of an environmental physics learning activity with the insertion of spiritual values that has been carried out is the concept of the hydrological cycle. An example of the visualization used in explaining the concept of the hydrological cycle can be seen in Figure 3.

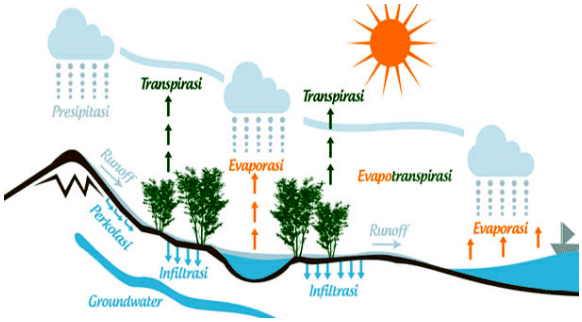


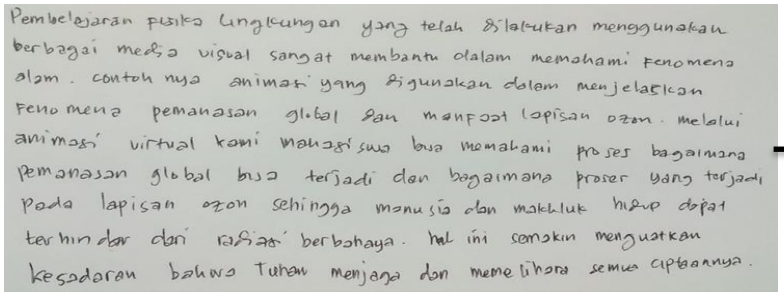
Figure 3. One of the visual media snippets in learning activities, especially the concept of the hydrological cycle (Source: World of Education)

The visualization media used to explain the concept of the hydrological cycle helps students to see the processes that occur during the hydrological cycle. Visual media helps to understand the interrelationship between physics concepts in explaining natural phenomena such as the process of the hydrological cycle. Visualization can explain the correlation between variables in a phenomenon (Werts & Hinnov, 2011). Demonstrations involving modelers, videos or virtual animations, posters, and graphs displaying the growth of atmospheric CO_2 and total temperature affect understanding and awareness of the environment (Saribaş et al., 2016). Representations in the form of

pictures or diagrams can represent students' conceptions of the nature of science (Colagrande et al., 2016).

The insertion of spiritual values is not only through the delivery of factual knowledge insights such as explaining that in life there is rain that affects environmental conditions. Strengthening spiritual values is not just about conveying the fact that rain falling from clouds can be large enough to meet the needs of water in the environment but the insertion of spiritual values is done by conducting concept focus with the help of visual media. However, due to the difference in temperature and pressure between the coastal area and the highlands, clouds formed from the evaporation and condensation process can also be blown to various areas including the highlands. By understanding the concepts of physics on the phenomenon of the hydrological cycle, the spiritual value that can be inserted is that God is merciful to all creatures. Concept focus assisted by visual media facilitates students to be able to know that the largest source of evaporation is in the sea area. In addition, the use of visual media also makes learning more interesting. This is relevant to previous research which states that learning that uses virtual visualization as a game can increase enthusiasm or interest in learning and is an important factor for the success of learning activities (Ismawati et al., 2014; Lee & Pang, 2013; McConnell & Kraft, 2011). This is relevant to Khoiriah et al. (2016) which states that multimedia teaching materials in the form of text, graphics, images, audio, video, and animation have a more significant effect on cognition.

Another spiritual value that can be inserted in the concept focuses on the hydrological cycle phenomenon is that God is all-organizing and takes everything into account. God has regulated and taken into account the variations in temperature and pressure with great precision on every surface of the earth so that although the largest source of energy is in the sea area, variations in pressure cause rain-bearing clouds to spread throughout the region not only in the sea surface area. Thus it can be said that the use of visual media is very helpful in understanding the concept of environmental physics and strengthening spiritual values. This is relevant to the student response to the open-ended questionnaire which states that visual media can help understand the relationship of physics concepts in explaining the process of natural phenomena that cannot be observed with the naked eye so that it better illustrates God's power through various natural phenomena invisible to the eye. The results of the research (Bezen et al., 2016) show that learning activities can be effectively supported with the help of virtual animation. A snapshot of student responses can be seen in Figure 4.



After attending physics lectures, I can conclude that the process of environmental physics has helped me realize that God has meticulously arranged everything. This is evident from the spiritual values embedded in the material, specifically that the hydrological cycle never ceases from the atmosphere to the earth and back again to the atmosphere through continuous processes

Figure 4. Student responses to the open-ended questionnaire explaining the advantages of visual media in learning environmental physics and strengthening spiritual values.

The strengthening of spiritual values in the indicator of realizing the reasons for the need to be wise towards nature and realizing the reasons for the need to be grateful to God is thought to be due to the integration of environmental physics learning that has been done with disaster mitigation content. In the physics concept of clouds and rain, students are presented with visual media at the focus concept stage to understand the formation of clouds and rain. A snapshot of the visualization used in learning activities can be seen in Figure 5.

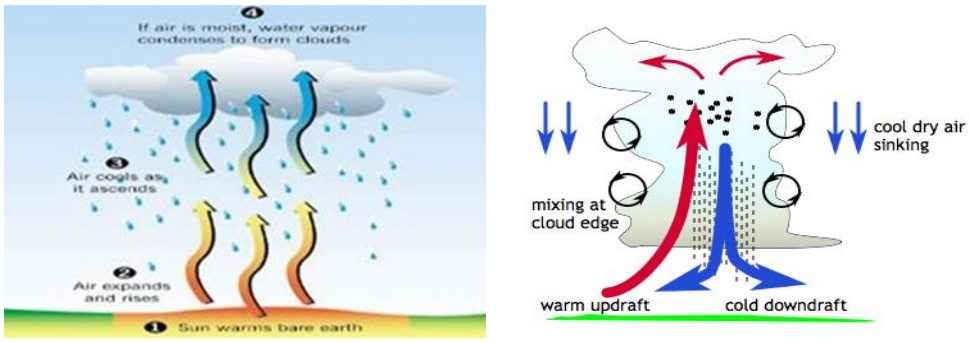


Figure 5. One of the visual media snippets in learning activities, especially the concept of clouds and rain (Source: geografi.org and CMMAP)

The concept of clouds and rain is presented with the help of visual media in the form of virtual images and animations. Clouds that form in Indonesia are generally dominated by Cumulonimbus (CB) clouds with the character of heavy rain accompanied by lightning. Students are allowed to discuss so that classroom interaction occurs. Classroom interaction is thought to provide opportunities for students to exchange opinions related to spiritual values that can be explored in various concepts and phenomena discussed in environmental physics lectures. In the concept of cloud and rain physics, students explore the relationship between the concept of cloud and rain characters in tropical Indonesia with Indonesia's natural conditions where some natural damage occurs such as forest changes into oil palm plantation areas and the rapid development of residential areas. The character of CB clouds that bring heavy rain with high intensity and the existence of environmental damage cause various natural disasters such as floods and landslides. The spiritual value explored is the need to be wise towards nature such as not destroying nature. So that preventive action can be taken to avoid natural disasters.

In addition, the process of clouds is also directed at strengthening spiritual values related to God's omnipotence and gratitude to God for the blessings of rain because water is one of the main components in the lives of all living things. However the farther away from the earth's surface, the lower the temperature change. The vertical variation of air temperature in the troposphere layer is that the higher the air temperature the smaller. This is what causes the upward convection currents that carry water vapor from evaporation from the sea, rivers and others can rise upwards so that condensation occurs. It cannot be imagined that if the vertical change in air temperature is the opposite, clouds and rain will never form and the hydrological cycle will never occur. Water is the main component if there are no clouds, rain, and the hydrological cycle then it can certainly have an effect on the environment and the lives of living things. From this phenomenon, we can realize how everything has been arranged, and calculated in such a way, a giver of grace, and teaches us gratitude to God.

The strengthening of good spiritual values is also thought to be due to the connection of the ICI stages used. One of them is at the stage of using text, students

are given reading cases related to the phenomenon of seasonal and climate change in Indonesia. The use of research-based materials in the form of visualization of authentic data modeling in discussing the case provides students with the opportunity to know the real conditions of the Indonesian atmosphere related to climate and weather. It is known that the Earth's revolutionary motion around the sun has an impact on seasonal changes. In the subtropics, there are 4 seasonal changes, and in tropical regions such as Indonesia, there are 2 seasonal changes. The visualization used in discussing the concept of seasons and climate is in the form of images and virtual animations of the sun's revolutionary motion. A snapshot of the animation used in learning activities can be seen in Figure 6.

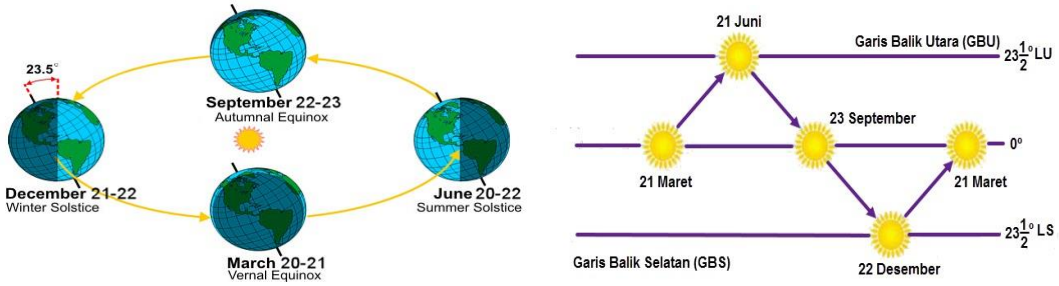
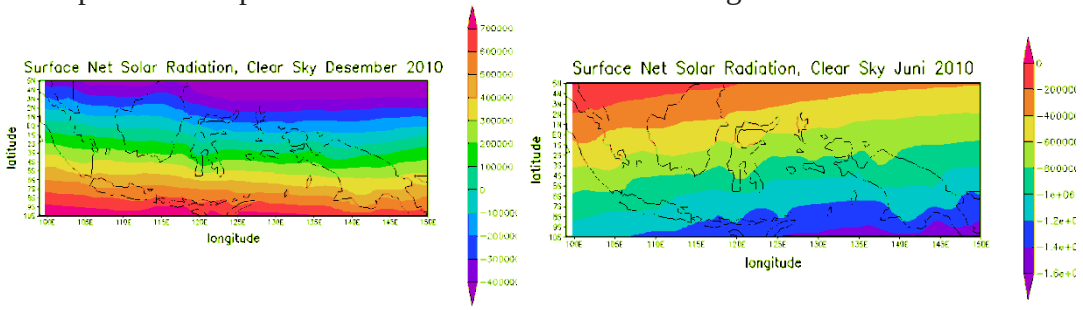


Figure 6. Earth's revolutionary motion (source: BBC.com)

The revolution of the earth causes the seasons. In Figure 8, it can be seen that in June the Northern Earth (BBU) region faces the sun, resulting in summer in the BBU and winter in the Southern Earth (BBS). While in December the BBS region faces the sun so that summer occurs in the BBS and winter in the BBU. Meanwhile, in tropical regions such as Indonesia, there are changes in two seasons, namely the rainy season and the dry season. This phenomenon implies that God regulates and balances environmental conditions with these seasonal changes. Real conditions in Indonesia can be described by modeling authentic data using GrADS software for data on the amount of solar radiation and atmospheric temperature in June and December sampled in 2010. The reference to the model in this year is because in that year the atmospheric data pattern is still relatively normal and there are rarely weather anomalies like lately so it can provide examples of real data that support concepts related to heat distribution by the theory of the annual journey of the sun (Ellwein et al., 2014). states that data-based teaching materials facilitate students to get meaningful learning stated that the presentation of modeling from authentic data provides an opportunity for students to interpret data and understand real environmental conditions. A snapshot of the visualization of authentic data modeling results using GrADS software used in learning activities can be seen in Figure 7.



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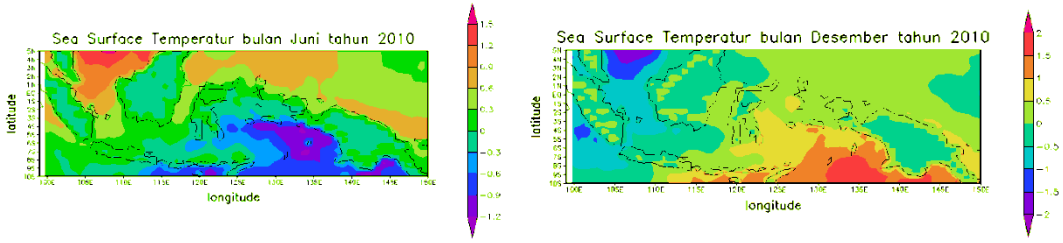

b

Figure 7a, b. Visualization of the results of modeling authentic data using GrADS software, a. Modelling data of the amount of solar radiation reaching the earth in Indonesia in June and December 2010; b. Modeling data of temperature in Indonesia in June and December 2010.

Modelling data on the amount of solar radiation reaching the earth in Indonesia in June and December and the temperature in Indonesia shows that in June the amount of sunlight in BBU is higher and the air temperature is also higher than BBS. In contrast to December where the amount of sunlight in BBS is higher and the air temperature is also higher than in BBU. In other words, in June there was summer in BBU and in December there was winter in BBU. This clearly shows that there is a change in seasons which indicates the spiritual value of God's balancing act. The spiritual aspect is important as it prevents the degradation of morality. It also increases our awareness of God Almighty (Muthohar, 2016).

CONCLUSION AND SUGGESTION

Based on the results of data analysis, it can be concluded that learning environmental physics assisted by visual media and authentic data modeling using GrADS software can facilitate the strengthening of spiritual values of science education graduate students. More than 90% of students stated that environmental physics learning activities that have been carried out can strengthen awareness of the nature of God. The concept of environmental physics is closely related to various natural phenomena. These phenomena are processes that cannot be observed directly. Visual media is very helpful in presenting the process of natural phenomena and facilitating the planting of spiritual values. Visualization using authentic data modeling facilitates students to understand the real conditions of the environment. Strengthening spiritual values through learning environmental physics can be an alternative learning that can form a religious character to avoid moral decline.

AUTHOR CONTRIBUTIONS

HJ: Research Concept and Design, Collection and/or Assembly of Data, Data Analysis and Interpretation, Writing The Article, and Final Approval of The Article; AM: Critical Revision of The Article; RWW: Collection and/or Assembly of Data; AH: Data Analysis and Interpretation; and S: Collection and/or Assembly of Data, and Critical Revision of The Article.

REFERENCES

Bachtiar, A., Sholehudin, Ningsih, M., Sabilahaq, T., & Johan, B. (2024). Relevansi Al-Qurán Surah Ar-Rad ayat 8 pada fisika materi pengukuran. *Al-Iltizam : Jurnal Pendidikan Agama Islam*, *9*(1), 23–31.

Bezen, S., Aykutlu, I., & Bayrak, C. (2016). Conceptual comprehension of pre-service physics teachers towards 1st law of thermodynamics. *Journal of Turkish Science Education*, *13*(1), 55–75. https://doi.org/10.12973/tused.10157a

Colagrande, E. A., Martorano, S. A. A., & Arroio, A. (2016). Assessment on how pre-service science teachers view the nature of science. *Journal of Turkish Science Education*, *13*(4), 293–307. https://doi.org/10.12973/tused.10186a

Duncan, D. K., & Arthur, L. (2012). Improving student attitudes about learning science and student scientific reasoning skills. *Astronomy Education Review*, *10*(1), 1–11.

Ellwein, A. L., Hartley, L. M., Donovan, S., & Billick, I. (2014). Using rich context and data exploration to improve engagement with climate data and data literacy: Bringing a field station into the college classroom. *Journal of Geoscience Education*, *62*(4), 578–586. https://doi.org/10.5408/13-034

Fraser-Pearce, J. (2022). Spiritual education as a subspecies of relational education? *British Journal of Religious Education*, *44*(1), 112–121. https://doi.org/10.1080/01416200.2021.1877613

Günay, A. A., Sett, S., Oh, J., & Miljkovic, N. (2017). Steady method for the analysis of evaporation dynamics. *Langmuir*, *33*(43), 12007–12015.

Harlos, K. P. (2000). Toward a spiritual pedagogy: Meaning, practice, and applications in management education. *Journal of Management Education*, *24*(5), 612–627. https://doi.org/10.1177/105256290002400506

Hookway, N. (2014). Moral decline sociology: Critiquing the legacy of durkheim. *Journal of Sociology*, *51*(2), 271–284. https://doi.org/10.1177/1440783313514644

Husamah, H., Suwono, H., Nur, H., & Dharmawan, A. (2022). The development and validation of environmental literacy instrument based on spirituality for prospective science teachers. *Eurasia Journal of Mathematics, Science and Technology Education*, *18*(12). https://doi.org/10.29333/EJMSTE/12732

Ismawati, F., Nugroho, S. E., & Dwijananti, P. (2014). Penerapan model pembelajaran conceptual understanding procedures untuk meningkatkan curiosty dan pemahaman konsep siswa. *Jurnal Pendidikan Fisika Indonesia*, *10*(1), 22–27. https://doi.org/10.15294/jpfi.v10i1.3047

Johan, H., Mayub, A., & Sipriyadi. (2021). Student spiritual value through environmental science learning. *Proceedings of the International Conference on Educational Sciences and Teacher Profession (ICETeP 2020)*, *532*(1), 210–213. https://doi.org/10.2991/assehr.k.210227.037

Johan, H., Suhandi, A., Samsudin, A., & Ratna Wulan, A. (2017). Exploring spiritual value in earth science concept through learning using chain till unanswered questions. *AIP Conference Proceedings*, *1868*(1), 1–8. https://doi.org/10.1063/1.4995188

Jolley, A., Lane, E., Kennedy, B., & Frappé-Sénéclauze, T. P. (2012). SPESS: A new instrument for measuring student perceptions in earth and ocean science. *Journal of Geoscience Education*, *60*(1), 83–91. https://doi.org/10.5408/10-199.1

Kali, Y. (2003). A virtual journey within the rock-cycle: A software kit for the development of systems-thinking in the context of the earth's crust. *Journal of Geoscience Education*, *51*(2), 165–170. https://doi.org/10.5408/1089-9995-51.2.165

Kamus, Z., Asrizal, & Sari, S. A. (2020). Development of spiritual intelligence values in learning materials of Physics to support reinforcement of character education. *Journal of Physics: Conference Series*, *1481*(1), 1–8. https://doi.org/10.1088/1742-6596/1481/1/012112

Karwadi, K. (2008). Integrasi paradigma sains dan agama dalam pembelajaran aqidah (ketuhanan) (telaah teoritis dari perspektif kurikulum integratif). *Jurnal Penelitian Agama*, *17*(3), 516–536.

Kastens, K. (2010). Commentary: Object and spatial visualization in geosciences. *Journal of Geoscience Education*, *58*(2), 52–57.

Khoiriah, Jalmo, T., & Abdurrahman. (2016). The effect of multimedia-based teaching materials in science toward students' cognitive improvement. *Jurnal Pendidikan IPA Indonesia*, *5*(1), 75–82. https://doi.org/10.15294/jpii.v5i1.5793

Lee, P. L., & Pang, V. (2013). Motivational factors in continuing education an academic achievement of adult learners. *Malaysian Journal of Learning and Instruction*, *10*(1), 57–77.

Lubis, M. D., & Darmana, A. (2024). The effect of teaching materials for chemical equilibrium based on spiritual values on student learning outcomes in the guided inquiry learning model. *Jurnal Teknologi Pendidikan : Jurnal Penelitian Dan Pengembangan Pembelajara*n, *9*(2), 247-255. https://doi.org/10.33394/jtp.v9i2.11125

McConnell, D. A., & Kraft, K. J. van D. H. (2011). Affective domain and student learning in the geosciences. *Journal of Geoscience Education*, *59*(3), 106–110. https://doi.org/10.5408/1.3604828

Miller, B. W., & Brewer, W. F. (2010). Misconceptions of astronomical distances. *International Journal of Science Education*, *32*(12), 1549–1560. https://doi.org/10.1080/09500690903144099

Mulyasa. (2013). *Pengembangan dan Implementasi Kurikulum 2013 (Perubahan dan Pengembangan Kurikulum 2013 Merupakan Persoalan Penting dan Genting)*. Bandung : Remaja Rosdakarya.

Muthohar, S. (2016). Antisipasi degradasi moral di era global. *Nadwa: Jurnal Pendidikan Islam*, *7*(2), 321–334. https://doi.org/10.21580/nw.2013.7.2.565

Prain, V., Tytler, R., & Peterson., S. (2009). Multi representation in learning about evavoration. *International Journal of Science Education*, *31*(6), 787–808.

Rosnita, R. (2016). The development of laboratory-based earth and space science learning model to improve science generic skills of pre-service teachers. *Jurnal Pendidikan IPA Indonesia*, *5*(2), 171–176. https://doi.org/10.15294/jpii.v5i2.7677

Rukmana, D., Suhandi, A., Ramalis, T. R., & Samsudin, A. (2022). Religious values-based learning materials on earth and space science: analysis spirituality and conceptual understanding levels. *Indonesian Journal of Science and Mathematics Education*, *5*(3), 271–284. https://doi.org/10.24042/ijsme.v5i3.12489

Rusydiana, M. (2024). Integrasi Ayat-ayat Al- Qur ' an dalam pembelajaran fisika pada konsep gaya. *Religion: Jurnal Agama, Sosial, Dan Budaya*, *3*(3), 512–521.

Santos, V. C., & Arroio, A. (2016). The representational levels: Influences and contributions to research in chemical education. *Journal of Turkish Science Education*, *13*(1), 3–18. https://doi.org/10.12973/tused.10153a

Saribaş, D., Küçük, Z. D., & Ertepinar, H. (2016). Evaluating effects of an exhibition visit on pre-service elementary teachers' understandings of climate change. *Journal of Turkish Science Education*, *13*(1), 19–30. https://doi.org/10.12973/tused.10154a

Septian, R., Zulhendri, A., Masril, K., Afrizon, R., Fisika, J., Universitas, F., & Padang, N. (2019). Implementasi bahan ajar fisika terintegrasi kecerdasan sosial dalam model pembelajaran berbasis masalah pada kelas X SMAN 16 Padang. P*illar of Physics Education*, *12*(1), 137–144.

Sholikhah, A. U., Rofiqah, A., & Effendi. (2024). Pengembangan e-modul interaktif terintegrasi Al - Qur'an

menggunakan H5P dalam membentuk kompetensi spiritual (Ki - 1) Pada materi sistem tata surya. *Titian Ilmu: Jurnal*, *16*(1), 1-7. https://doi.org/10.30599/jti.v16i1.2783.

Smith, G. A., & Bermea, S. B. (2012). Using students' sketches to recognize alternative conceptions about plate tectonics persisting from prior instruction. *Journal of Geoscience Education*, *60*(4), 350–359. https://doi.org/10.5408/11-251.1

Ten, H. (2018). Moral decline. *International Journal of Ethics Education*, *3*(2), 107–108. https://doi.org/10.1007/s40889-018-0063-5

Torres, J. R. F. (2009). How do preservice teachers' religious beliefs affect their understanding of astronomy? *Astronomy Education Review*, *7*(2), 25–39.

Santyasa, I. W., Suastra, I. W., & Astawan, I. G. (2017). The importance of physics text book in connecting concepts and principles with character values and social attitude as well as spiritual attitude. *Advances in Social Science, Education and Humanities Research*, *134*(1), 21–26. https://doi.org/10.2991/icirad-17.2017.5

Werts, S., & Hinnov, L. (2011). A simple modeling tool and exercises for incoming solar radiation demonstrations. *Journal of Geoscience Education*, *59*(4), 219–228. https://doi.org/10.5408/1.3651449

Wickström, L. (2012). Contemporary environmentalism as a current of spiritual post-secular practice. *Scripta Instituti Donneriani Aboensis*, *24*(2010), 419–432. https://doi.org/10.30674/scripta.67425