Module of Renewable Energy from the Earth's Gravity Based on Islam as Teaching Materials for Tadris IPA Study Program

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Abstract: Gravity is a renewable energy source that has not been widely studied, although many scientists have researched and made prototypes of tools that use it. This article describes the development of a module of renewable energy from the Earth's gravity based on Islam as teaching material for the Tadris Science study program. This research used Research and Development (R&D) method by Borg and Gall but modified only until the product revision stage. The validation results are 88.3% in the very good category from the material expert, 82.6% in the very good category from the media expert, and 89% in the very good category from the learning expert. This study concludes that students can use the developed product.

Keywords: Energy, Renewable, Module, Gravity

INTRODUCTION

Living things live very dependently on energy (Adriel & Sutisna, 2021), for example, for lighting and heating at homes, cooking, washing clothes, transportation, communication, and running large-scale (in factories), medium and small industries (home industries). The energy of all activities cannot be carried out. Civilization will also be lost if the energy runs out in their area. Usually, residents in those areas will move to look for new energy to meet their needs. Thus, it can be seen that humans need energy (Brand-Correa & Steinberger, 2017; Kandi & Winduono, 2012).

In our daily life, we use energy with the consideration that it can facilitate activities or get comfort and services according to our needs (Davey, 2012). For example, lifting weights using human power has minimal capabilities compared to machines. The higher the capability of a machine, the higher its energy requirements. Users tend not to consider where the energy source comes from at the energy user level. It shows that energy users take full advantage of it without considering the availability of the energy sources (Stavrakas & Flamos, 2020).

The benefits of using energy are seen in many activities. In transportation activities, fossil fuels, such as gasoline, diesel, and coal, are used as energy sources so that we can travel long distances without refueling repeatedly. In this case, fossil fuels help activity and mobility. However, it also has a terrible toll (Kotcher et al., 2019; Machol & Rizk, 2013; Perera, 2017; Perera, 2018). Every human being who feels the pleasure of the industrial revolution must participate in conserving this

energy with two choices: preserving non-renewable energy or looking for alternative resources. There are some questions: Are there Islamic sharia values that regulate energy conservation? How are conservation principles applied? The normative answer is in the following hadith:

> *From Jabir ra. said Messenger of Allah said, "Turn off the lights at night when you want to rest and close the doors, close the water tank, and close the food and drink." Hammam said, "Cover even if it is just a branch." (HR. Bukhari)*

Through this hadith, the Prophet taught his people to permanently save energy, even in small things like household lights. *Asbabul wurud* (cause of coming) of this hadith is the incident of one of the residents' houses that caught fire because they kept turning on the lights (fire) at night. Renewable energy developments are part of the common scientific and technological innovations in engineering technology (Ulum & Nurlia Latipah, 2021) It is a part of the world's affairs that is left entirely to the creativity and innovation of the human mind. As in general technological developments, as long as it does not cause *madlarat* or *mafsadah* in Islam's view, there are no prohibitions.

However, why is it necessary to support religious views (fiqh) to convince this renewable energy innovation? As a good idea and movement, renewable energy innovation needs much support, not only social, economic, and political support but also religious and moral support so that everything can run in harmony and balance. However, this support is not to be legitimized. In addition to the need to reduce greenhouse gas emissions, it has made renewable resources attractive in the world's energy-based economy. The potential of renewable energy resources is enormous because, in principle, they can exceed the world's energy needs exponentially (Ellabban et al., 2014; Qazi et al., 2014; Moriarty & Honory, 2016; Gielen et al., 2019). The following are examples of renewable energy: biomass energy (Eichler et al., 2015), geothermal energy (Alhamid et al., 2016), hydroelectric energy (Bagher et al., 2015; Bonar et al., 2015), solar energy (Kannan & Vakeesan, 2016), and wind energy (Herzog et al., 2001).

Although the number of renewable energy sources is already significant, each energy source has its drawbacks due to the availability of sustainable biomass resources for biofuel and biochemical production (Field et al., 2008). Geothermal energy has disadvantages, such as high initial investment, long payback and construction times, and difficulty valuing resources and modulating (Li et al., 2015). Dams disrupting river flow, damaging local ecosystems, and constructing large dams and reservoirs involving the displacement of people and wildlife are the disadvantages of hydroelectric energy (Bagher et al., 2015).

The disadvantages of solar energy fall on the photoelement at a certain angle depending on the environmental climax, season, and location. Changes in the atmosphere also cause transverse and direct rays, which do not change the light, spectrum, and intensity of the falling light (Ugli, 2019). Noise, bird and bat deaths, greenhouse gas emissions, and ground-level impacts are the downsides of wind energy (Wang & Wang, 2015; Jaber, 2014). According to Newton's law of general

gravitation between two objects, gravity is an attractive force whose magnitude is directly proportional to the masses of each object and inversely proportional to the square of the distance between them (Syaepudin et al., 2017).

With this movement, it can be used as an energy source in the renewable energy category. Scientists such as Leonardo di ser Piero da Vinci once made a device called the Da Vinci Overbalanced Wheel, where a load will fall due to the gravity of the Earth and make the wheel spin and cause another load to be lifted, and this pattern repeats itself. Villiard de Honnecourt Overbalanced Wheel is the work of a scientist from France, Villiard de Honnecourt. This wheel will rotate continuously due to the load that continues to fall due to the Earth's gravity, and theoretically, if the rotating shaft is connected to the turbine, it will rotate the generator and produce electricity.

Robert Boyle Flusk is the work of Robert Boyle from Ireland, which allows this water or fluid to move continuously after falling and has the potential to turn turbines and generate electricity (Mahesh, 2018). Even though this gravity already exists, the Earth's gravity power plant is designed (Islam & Ravindra, 2017). However, no specific module reference examines gravity as a renewable energy source. Based on the preliminary study results, gravity is not included in textbooks for students at school and lectures. For this reason, researchers are interested in developing a module of renewable energy from the gravity of the Earth based on Islam for the science study program. Some have researched modules related to energy (Aulianingsih et al., 2021; Faizah, 2022). However, it does not list gravity as a renewable energy source and does not study it in depth, even though students need an integrated Islamic science module (Vitrianingsih et al., 2021).

This research contributes to many fields. The existence of this reference book will bring up new research field references, such as developing renewable energy from Earth's gravity that can be made anywhere and free from pollution. Education also contributes to this research in obtaining additional new material in renewable energy from Earth's gravity. The authors realize that developing technology must start from the learning process in the classroom and requires references. This study aims to determine the feasibility test results for developing a module of renewable energy from Islamic gravity for the natural science study program.

METHOD

This research used Borg and Gall's research (R&D) method. This method intends to produce a specific product where this research is a module for developing a module of renewable energy from gravity. Earth based on Islam for the Tadris IPA study program, which is then followed by a product feasibility test, includes potential and problems, data collection, product design, design validation, design revision, product testing, product revision, usage testing, product revision, mass production (Haviz, 2016). In the several development stages, the researchers limited the research steps.

The limitation of development steps was carried out because this study aims to determine the feasibility and attractiveness of the developed product. Considering the limited time and resources, the study only used seven stages of

development by Borg & Gall: potential and problems, data collection, product design, design validation, product revision, product testing, and product revision (Akbar & Komarudin, 2018; Rodiawati & Komarudin, 2018; Septina et al., 2018). The instruments used in this study were non-test instruments in the form of media, learning, and material expert validation sheets (science and religion) and student and educator response questionnaires. This research instrument quotes Puspita (2019), tested for validity and reliability. The instrument used a Likert scale of 1-4, with 4 as the highest and 1 as the lowest score, as found in Table 1. The Likert scale measures attitudes, opinions, and perceptions of a person or group about social events or phenomena (Asyhari & Silvia, 2016).

Table 1. Media Expert Validation Assessment Score (Media, Material, and Language)

Category	Score
Very good	4
Good	3
Bad	2
Very Bad	1

The validation results written on the validation sheet will be analyzed using the equation of the percentage of questionnaire data obtained from the total score divided by the maximum number of scores multiplied Purwanto, (2009) by 100% Furthermore, the percentage obtained is interpreted into categories based on Table 2.

Table 2. Media Eligibility Criteria (Sugiyono, 2018)

Percentage (%)	Category
0-20	Very Bad
21-40	Bad
41-60	Enough
61-80	Good
81-100	Very good

RESULTS AND DISCUSSION

After the development stages, the research product is obtained the language feasibility of the developed product and gets advice from experts, and then this step is carried out. This research used two material experts: science and Islamic religion, especially in interpretation, media, and linguistics. Figure 1 presents the results of the assessment of each validator:

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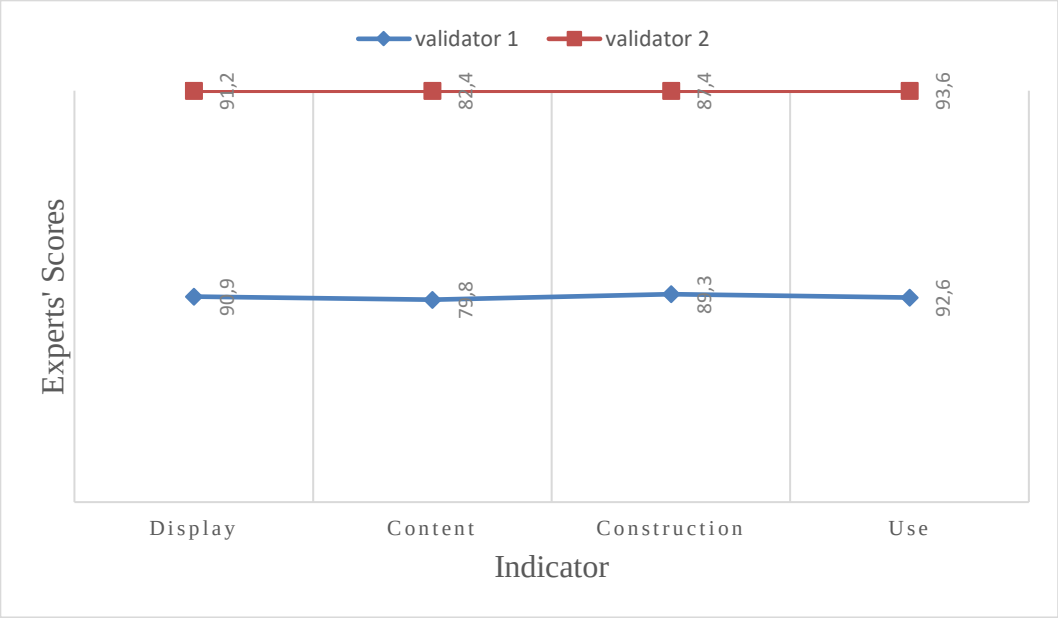

Figure 1. Results of material expert assessment (science and religion)

The results include four aspects: appearance, content, construction, and use. Each score is displayed in the bar chart. The x-axis is an indicator, and the y-axis is a score from the experts. Figure 2 presents the results of material expert validation are 88.3% in the very good criteria

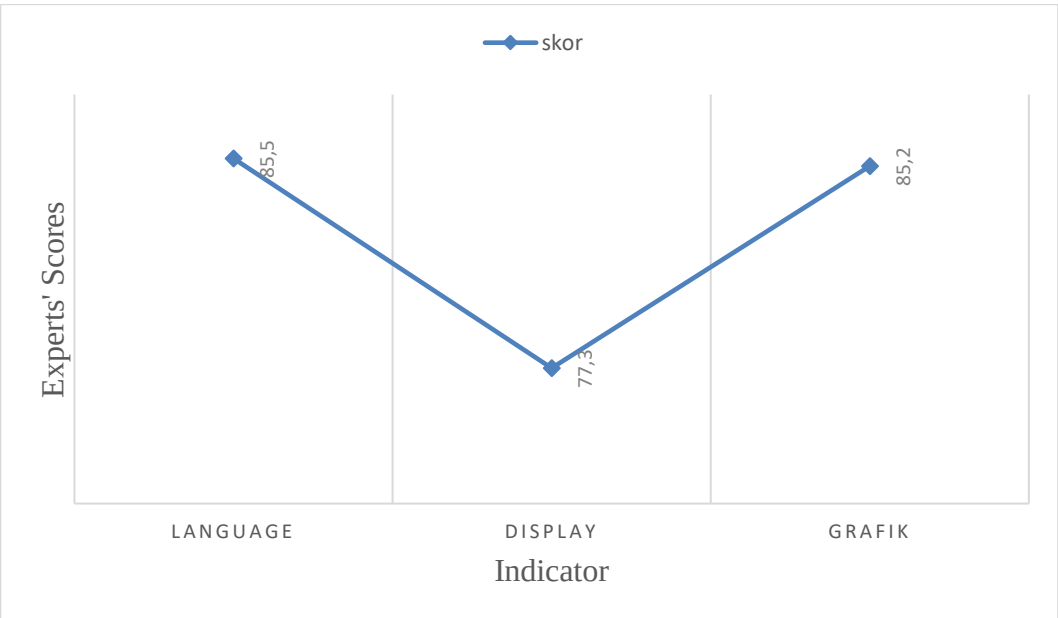

Figure 2. Results of the media expert's assessment

The assessment includes three aspects: language, display, and graphics. Each score is displayed in the bar chart. The x-axis is an indicator, and the y-axis is a score from the experts. Figure 3 presents the results of material expert validation are 82.6% in the very good category.

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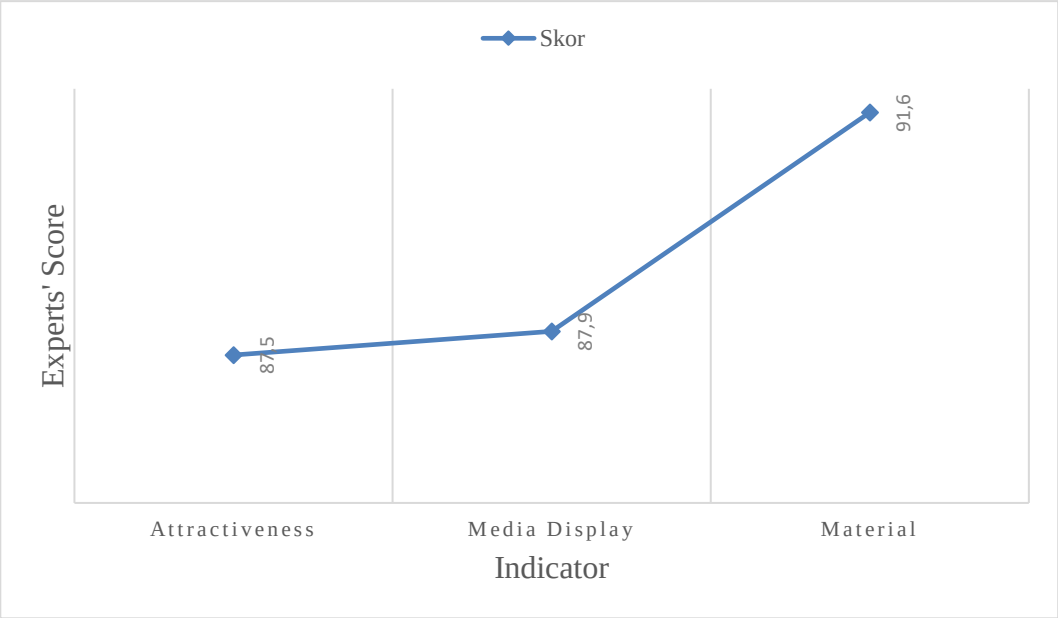

Figure 3. The results of the learning expert assessment

The assessment includes three aspects: attractiveness, media display and material. Each score is displayed in the bar chart. The x-axis is an indicator, and the y-axis is a score from the experts. The results of material expert validation are 89% in the very good category.

Researchers chose to develop products in the form of modules because they can facilitate participants to learn, both with educators and independently. Modules are teaching materials that are packaged in their entirety and schematically (Ardiansyah et al., 2016). The developed product specifications follow the guidelines for the preparation of the teaching module, which must meet four criteria: interesting, meaningful, challenging, relevant and contextual, and sustainable (Ministry of Education and Culture, (2021), (Aldila et al., (2020). The selection of modules as teaching materials improves students' skills (Dewi et al., 2019; Kusmaharti, 2022; Setiawan et al., 2017; Usman et al., 2019; Serevina et al., 2018; Zulfahrin et al., 2019). However, the module has advantages and disadvantages (Khoirudin, 2019; Puspitasari, 2019).

The following are materials in the module product: energy needs, energy demand, energy in physics (energy and work, forms of energy, classification of energy sources), energy savings, prototypes of tools that utilize Earth's gravity (definition and examples), renewable energy in Islam, making props for gravity-powered mobile cars, the balance of rigid bodies, the center of gravity, and advantages and disadvantages of using gravity as a renewable energy source. The impact of this paper is that it can provide a new reference that examines renewable energy from gravity based on Islam. There is a form of renewable energy that has never been included in textbooks for both elementary and college levels. Even though Earth's gravity energy does not depend on the weather and is relatively the same in all parts of the Earth, there are several studies by previous scientists who

have succeeded in making tools that can move on their own due to the Earth's gravity) (Hosseini et al., (2018); Carbone et al., (2020). The number of recent studies examining Earth's gravity as a renewable energy source is still tiny, so very few people know about it. In scientific searches that researchers do in scientific articles and journals both nationally and internationally,

That is why we need a book or module that contains and describes the potential, utilization, teaching aids, research results, and practicum related to Earth's gravity because the world of education is an early milestone in technological development. The number of teaching materials that study Islamic studies in renewable energy sources from elementary to university level is still minimal. Even those who study Islam about renewable energy, especially Earth's gravity, do not yet exist even though this material is widely taught in the Tadris IPA study program of UIN FAS Bengkulu. Many courses will use these teaching materials, including basic physics, conservation of natural resources, basic biology, science and Islamic studies, earth and space sciences, and others (Kembara et al., 2020).

CONCLUSION

The product validation results are 88.3% in the very good category from the material expert, 82.6% in the very good category from the media expert, and 89% in the very good category from the learning expert. These results show that the developed product can be used by students, especially those from the Tadris IPA study program because there has been no module discussing renewable energy from gravity based on Islam. The next research recommendation is not only to theoretically study renewable energy from gravity but also to develop it into reality because prototypes of tools that use gravity as a driving force already exist.

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