

Development of Learning Media Articulate Storyline: Needs Analysis for Integration of ESD in Science Education

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Abstract

Technology and environmental-based learning are transformed to promote flexibility and foster sustainability awareness. Cow dung waste, as a contributor to the greenhouse effect, presents an engaging issue for learning. This study aims to explore teachers' instructional activities and challenges, identify students' initial awareness of sustainability, and present an alternative instructional media design. A descriptive qualitative method was used, involving 17 teachers and 47 students through surveys. Findings show that most teachers use a scientific approach with lectures and discussions, and 94.1% rely on picture media, which lessens student engagement. All teachers expressed the need for multimedia learning, with 64.7% developing media independently. None have used Articulate Storyline, a potentially interactive, offline/online-accessible tool. Teaching topics like biogas and its relevance to Education for Sustainable Development (ESD) are often not addressed 47.1% of teachers omit them. Students' sustainability awareness levels were: 54.9% moderate in practice, 79.1% in behavior and attitude, and 83% high in emotional awareness. Developing Articulate Storyline-based media with the theme of cow dung waste is recommended as an effective ESD learning alternative.

Keywords: Sustainability Awareness, Environmental Based Learning, Articulate Storyline, Education, Learning Media

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Introduction

The livestock sector in Indonesia is still a strategic source of food security. Based on Indonesian Central Statistics Agency reported data in 2020, the total population of cows in Indonesia reaches 17,679,7111 heads. The increase in beef production indicates in the community there is an increase in the need for beef consumption in the context of fulfilling animal protein nutrition ([Romansah, 2020](#); [Khoshnevisan 2021](#)). However, the problem of the increase in cattle production is not matched by the ability of farmers to process cow manure waste, resulting in complex issues. Waste handling cattle mostly flowed into the river, so that raises hygiene and environmental health problems ([Surwani et al., 2020](#)). In addition, livestock is one of the 5 sectors that contribute to greenhouse gases, causing global warming ([Mashur, 2020](#)).

On the other hand, cow dung can be one of the potential ingredients for making bioenergy. Processing of livestock waste through anaerobic or fermentation processes needs to be encouraged because it can produce biogas which is a type of bioenergy. It is hoped that processing livestock waste into biogas can reduce excessive dependence on fuel and reduce environmental pollution ([Oladejo et al., 2020](#)). The potential of cow waste for biogas is very potential because each cow that weighs 454 kg will produce 30 kg of feces and urine waste every day and if each farmer has 100 cows the amount of waste produced can reach 3 tons per day ([Putra et al., 2017](#)).

Based on the complex problem of handling cow dung waste, it needs to be resolved with a multidisciplinary and multidimensional approach. Contextual problems can be presented on the learning activities with learning the integration of ESD (*Education Sustainable Development*). This is because one of the current government's goals in education is to link science and environmental issues into everyday life. It aims to provide of knowledge, skills, attitudes, and values of sustainability

(*sustainability awareness*) to the student, in the face of environmental problems in the present and future ([Agbedahin et al., 2019](#); [Alsaati et al., 2020](#); [Flaherty & Liddy, 2020](#)).

Learning about making biogas can be input in class IX science subjects, specifically on environmentally friendly technology materials. This material can be taught with multimedia learning media because it can make students better understand abstract, interactive concepts and foster independence in students ([Wing et al., 2019](#)). One of the interactive multimedia learning media that can be used for learning is the Articulate storyline. The Articulate storyline is a multimedia authoring tool that can be used to create learning tools to interact with each other with content formed from a combination of text, images, graphics, sound, animation, and video.

Based on research conducted by [Latip & Permansari \(2015\)](#), it is stated that learning environmentally friendly technology using multimedia assistance can improve students' understanding of science concepts. Previous research conducted by ([Nugroho & Arrosyad, 2020](#)) stated that learning using multimedia articulate storylines on the theme of biodiversity was effective to apply. Therefore, pre development research on articulate storyline media analysis with the theme of integrated livestock biogas as the integration of ESD in science learning needs to be done so that the media design that is prepared can be used to overcome the limitations of media in the field of science learning, especially environmentally friendly technology.

Method

This research is a qualitative descriptive needs analysis study accompanied by a literature study to analyze the basic competence of science which can be linked to the values of ESD (*Education Sustainable Development*). The results of the needs analysis to obtain primary data are used as the basis for designing an integrated biogas farm biogas articulate storyline learning media, along with the process of implementing the learning as an integrated ESD learning process. In addition, there is supporting data to determine the extent of the *sustainable awareness values* currently held by students at the junior high school level.

The data collection technique used is a survey using a needs questionnaire. This survey method is a study whose main source is data and information is obtained directly from respondents using a questionnaire. The results of filling out the questionnaire from the teacher or student are described to determine the conditions of learning in the field based on the results of the answers.

Primary data obtained from 17 science teachers as respondents, provided information about 1) the implementation of learning activities, 2) the dominance of the learning media used, 3) the constraints faced by teachers while providing learning environmentally friendly technology materials, 4) teacher expectations and suggestions on the media articulate storyline that will be used, 5) teachers' knowledge about ESD (*Education Sustainable Development*) integrated learning. As well as supporting data obtained from 47 students, data on students' awareness of the values of sustainability (*sustainable awareness*) owned by junior high school students were obtained. Secondary data obtained about the design of the articulate storyline instructional media design that contains an awareness of sustainable development and can be inserted into ESD dimensions, namely (environmental, economic, social) and obtained steps in the learning implementation process using these media.

Research Results and Discussion

Description from result needs assessment

Based on the results of filling out the needs analysis questionnaire conducted by 17 junior high school science teachers, 58.8% of teachers experienced problems in carrying out learning, especially on environmentally friendly technology materials. One of the obstacles that respondents often encounter is the lack of learning media that can be used to convey this material. So far, images have become one of the learning media that is often used, namely around 94.1% of respondents use

gambars and state that student responses vary from lacking enthusiasm, mediocrity to enthusiasm. Based on these data teachers need the right media, attract students' interest, and can change complex learning to be simple, clear, and not abstract ([Indasari & Bidiyanto, 2017](#)).

Respondents 100% stated that multimedia learning media was able to increase student interest in learning and 64.7% of teachers began to design and develop multimedia media. Learning using multimedia will involve several senses so that all information conveyed by the teacher will turn into an interesting and motivating experience for students ([Indasari & Bidiyanto, 2017](#)). One of the choices of multimedia learning that can be used is *articulate storylines*. However, 76.5% of teachers do not know this media, and 100% of teachers never use *articulate storylines*. Media articulate storyline needs to be developed because it can be one of the *software* that serves as a medium of communication presentations to help to learn more interactive and create a fun and effective learning environment ([Dinda et al., 2021](#)).

Based on the resulting questionnaire by the teacher, data was also obtained that 100% of teachers always try to link learning with environmental problems, and 52.95 % of them teach about biogas. In addition, 47.1% of teachers have started to know about ESD (*Education Sustainable Development*), but most of them have never applied it to learning activities. ESD is important to apply because it is related to education that is holistic, transformative, can be linked to learning content, and can affect student learning outcomes. ESD supports independent learning, participation, and collaboration as a development of sustainable competence at all levels of education ([Cabrin et al., 2020](#)).

Basic Competency Analysis Result and confirmatory with SDGs Objective

The results of the secondary analysis obtained in the form of an analysis of basic competencies in the learning syllabus can be seen in Table 1.

Tabel 1. Basic Competency Analysis Results

Basic Competence	
Cognitive	Analyzing environmentally friendly technology products and processes for the sustainability of life
Psychomotor skill	Presenting works about simple technology processes and products that are environmentally friendly

Based on the results it was found that the media to be used was an articulate storyline that integrated with ESD as an implementation of science learning. The articulate storyline instructional media design is designed to teach even semester 9th- grade material, namely aspect cognitive dan skills. The choice of competence is associated with a document analysis of the SDGs (*Sustainable Development Goals*) which is shown as the urgency of the principles of ESD (*Education Sustainable Development*) sustainable development education. Based on the results of secondary analysis of the syllabus and literary, it was found that the media to be used was an articulate storyline that would later be integrated with ESD as an implementation of science learning. The articulate storyline instructional media design is designed to teach even semester 9th- grade material, aspect cognitive and Psychomotor skills. The choice of competence is associated with a literature analysis of the SDGs (*Sustainable Development Goals*) which is shown as the urgency of the principles of ESD (*Education Sustainable Development*) sustainable development education.

Table 2. Result of Analysis of Conformity with SDGs Objectives

The goals of the SDGs		SDGs indicators
6	Ensuring the availability and management of sustainable clean water and sanitation for all	improve water quality by reducing pollution, eliminating waste disposal and minimizing disposal of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling, and safe reuse globally.
7	Ensuring access to affordable, reliable, sustainable and modern energy for all	Ensure universal access to affordable, reliable, and modern energy services.
12	Ensure sustainable consumption patterns and predictions	Achieve environmentally friendly management of chemicals and other wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce the release of these materials into air, water and soil in to minimize the adverse effects of these materials on human health and the environment, and Substantially reduce waste production through prevention, reduction, recycling. and reuse measures.
13	Take swift action to address climate change and its impacts	Increasing education, raising awareness, and human and institutional capacities related to climate change mitigation, adaptation, reduction, and impact of early warning.

The results of the analysis of the SDGs points are used to address the indicators contained in the SDGs as a global goal. These indicators have important objectives and dimensions that can be linked to the material for making biogas, because they can become key issues in the topic of sustainable development. ESD has three important pillars that complement each other, namely economic, social and environmental so that in ESD learning these pillars must be emphasized on biogas learning to foster students' ability to think critically, be able to imagine challenge scenarios, and solve solutions for the future in a collaborative way.

Livestock Biogas Articulate Storyline Design

The results of the design of the flowcart of the articulate storyline learning media can be seen in Figure 1.

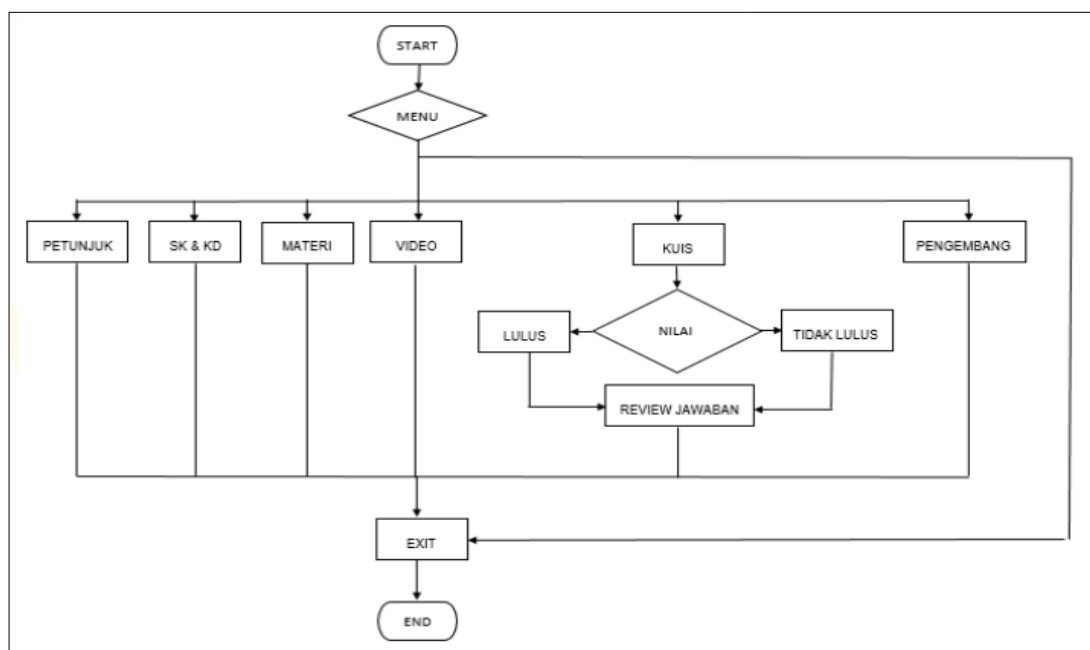


Figure 1. Biogas Articulate Storyline Flowchart Design

In the flowchart, there is a star tool which is part of the opening media with a cartoon animation background by bringing a set of biogas generator tools. Tools home menu contains instructions, SK KD, assignment materials, and videos. The material presented in the design of the articulate storyline that will be made contains the background of environmental problems in the cattle breeding area, the process of making biogas, and an analysis of the calculation of energy generated from cow dung waste. The quiz tool contains questions related to environmentally friendly energy, especially biogas and there is a review tool to see the results of the scores and discussion obtained. In addition, there are developer tools that contain the developer's identity and a brief explanation of interactive learning media, and an exit menu to close the articulate storyline.

Percentage Sustainability Awareness Students

Table 3. Percentage of sustainability awarness

Category Sustainability Awarness	Response "YES" (%)	Information
<i>Sustainability practice awareness</i>	54.9%	Usually done
<i>Behavioral and attitude awareness</i>	79.1%	Usually done
<i>Emotional awareness</i>	83%	Often done
Total Percent Overall	72.3%	Usually done

In this study, data on students' *sustainability awareness* was obtained before integrating learning using articulate storyline media and ESD-based learning. The number of questions in this questionnaire as many as 15 items and is divided into three categories namely *sustainability practice awareness*, *behavioral and attitude awareness*, and *emotional awareness*. The purpose of obtaining this data is as a measure to measure the sustainability of the students' sustainability, so that the articulate storyline learning media that will be developed will be in accordance with its intended purpose, which is to improve the sustainability of students' sustainability after the use of articulate storylines. In addition, the sustainability awareness can be used as a reference for learning interest by linking environmental issues such as biogas problems.

Based on the results of the recapitulation of the percentage of responses that are grouped into 3 categories, the first is *sustainable practice awareness*, the results obtained show that this behaviour is sometimes carried out by students with a response of 54.9% of students who do and 45.1% do not. From these results it can be concluded that students used to do this even though not very often. *Sustainability practice awareness* or conscious effort and run sustainability discuss the issue of the environment with friends, compost leftover food into fertilizer, do not use plastic bags for the packing of goods, to discuss the environmental issues with family and also participated in the awareness of the environment in schools to tackle environmental problems. This activity is usually done by students based on the questionnaire that is filled in. This behavior is a characteristic of the attitude that will be shown if someone already understands the concept of sustainability. Sustainability awareness among students enhances environmental literacy, fostering informed decision-making and encouraging sustainable practices ([Latifah et al., 2024](#); [Suna & Köse, 2023](#)). It also boosts critical thinking, promoting engagement with sustainability challenges ([Salsabila et al., 2019](#)), and encourages civic responsibility through participation in sustainability initiatives. Additionally, it opens career opportunities in sustainable industries ([Debrah et al., 2021](#)) and improves mental well-being by fostering a sense of purpose ([Vandaele & Stålhammar, 2022](#)). Ultimately, sustainability awareness bridges the gap between knowledge and action, motivating students to implement sustainable practices ([Wong & Wan, 2024](#)).

The second category is *behavioral and attitude awareness* or behavior and caring attitude towards the environment. Based on filling out the questionnaire, 79.1% of students did this behavior and 20.9% of students did not do this behavior. It can be concluded that the behavior and

caring attitude towards the environment (*Behavioral and attitude awareness*) owned by students is common. *Behavioral and attitude awareness* or caring behavior and attitudes towards the environment such as reading environmental issues in the mass media, respecting biodiversity, caring about motor vehicle fumes, recycling household waste, not turning on lights during the day and reducing the use of clean water is often done or the most may happen in life. This is the behavior and attitude shown when someone cares and is aware of the importance of the environment.

The third category, namely *emotional awareness* or care on the environment of emotions including attitudes or behavior that is always done by all students, the percentage of students who behave *emotional awareness* of 83% in the emotional students have a high awareness of the environment. Emotionally caring for the environment, such as feeling concerned about environmental problems, feeling disappointed with the pollution in the air and rivers and being aware of human responsibility for the environment is owned by students. Emotional awareness is closely tied to emotional intelligence, which has significant implications for students' success in multiple domains. Goleman's work suggests that emotional intelligence includes key components such as emotional awareness, self-regulation, and empathy, which are essential for effective interpersonal relationships and academic performance (Brackett et al., 2011). Educational interventions focusing on social and emotional learning (SEL) not only enhance students' emotional competencies but also lead to improved academic outcomes and better peer relationships (Durlak et al., 2011). This underscores the importance of measuring emotional awareness, particularly for the environment, so that it can be used as an indicator of student success in environmental awareness programs.

Based *sustainability awareness* or concern for the students sustained the best by categories that care about the environment *emotionally*, as students begin to understand and acknowledge that there must be a balance between the environment (Salsabila et al., 2019). The category of *sustainability practice awareness* of students was in the medium category even though it was the lowest percentage of respondents. This category is the most difficult category to achieve because students only have an awareness of environmental awareness, but very few have the effort to change in practice. The category of *behavioral and attitude awareness* is also in the moderate category, this means that students may lack a high level of awareness in reading and appreciate the environmental problems around them (Clarisa et al., 2020). This is due to factors such as cognitive dissonance, where students feel a disconnect between their awareness of environmental degradation and their lifestyle choices (Kwok, 2013). Furthermore, social norms and peer influence play a significant role; if sustainable practices are not normalized within their peer groups, students may be less motivated to adopt them (Subic-Wrana et al., 2014). Furthermore, perceived inefficiency, the belief that individual actions will not make a significant difference, also contributes to a lack of motivation (Bernard, 2023).

Conclusion

Based on the research results the learning media used in environmentally friendly learning materials are less varied and interactive because they are only limited to pictures. Teachers need multimedia learning media in the form of articulate storylines, because this media is easy to use by teachers or students. The results from questionnaire about the students' initial sustainability obtained the results of sustainability practice in the medium category, awareness of behaviour and attitudes in the medium category, and emotional awareness in the high category.

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