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Research Article

Creating Plant Anatomy Structure Model using Science, Technology, Religion, Engineering, Arts, Mathematics (STREAM) Approach

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ABSTRACT

The purpose of this study was to analyze the achievement of science-technology-religion-engineering-arts-mathematics (STREAM) aspects on products made by students. The product in question is in the form of a report of a Plant Anatomy structure model project. This research uses The Static-Group Comparison Design. Purposive sampling was carried out on 39 Biology Education students of class A in semester IV with project assignments without intervention through the STREAM approach (regular class). The intervention class, 38 students of class C in semester IV with project assignments using the STREAM approach (intervention class). Each student designs and creates one of the structure models of either roots, stems, or leaves. Students also make the project report, where the project report assignment guideline is in the form of a performance task. The research instrument of this study is an analytical rubric along with a score of 0 - 4 with certain criteria and field notes. The data measured in this study is the percentage of achievement on certain criteria. The results showed that the engineering aspect was the strongest in the intervention class, reaching the "excellent" category in the intervention class of 100%. The regular class reached 64.10% with the "good" criteria in the engineering aspect. The art aspect is the weakest in both classes with varying criteria. The achievement of criteria in the intervention class showed better results than the regular class. The STREAM approach can be applied to Biology Education students through the assignment of a Plant Anatomy structure model project.

1. INTRODUCTION

The global and national education system is being streamlined with a STEM (science-technology-engineering-mathematics) learning approach in various disciplines and levels of education from elementary school to university. The STEM approach is considered as a way to overcome workforce problems (Bybee, 2010; Hanover Research, 2011; Basham & Marino, 2013). In universities, lecturing processes that use the STEM approach can increase the nation's competitiveness and be able to create job openings (Natsir, 2018). Furthermore, STEM evolves with the addition of art (A), turning it into STEAM. The art aspect emphasizes students' skills in understanding science by expressing creativity, innovating, designing, developing technology, products, and displaying artistic values (Henriksen, 2014; Wijaya, 2015; Oner et al, 2016; Jho et al, 2016; Conradty & Bogner, 2019; Zubaidah, 2019).

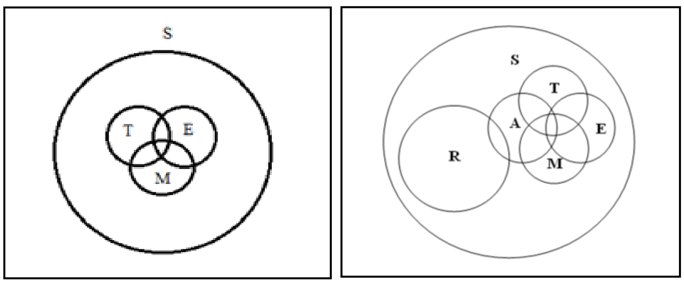
To support 21st-century skills, it is necessary to conduct various studies that provide higher-order thinking skills. STEM and STEAM learning approaches can support higher-order thinking skills (HOTS), among them is creativity (Partnership for 21st Century Skills, 2007; Henriksen, 2014; Ridwan et al, 2017; Nurlenasari et al, 2019; Zubaidah, 2019). STEM and STEAM approaches currently being developed often focused more on engineering and aesthetic skills. Various higher-order thinking skills, designing skills, and creativity should also be accompanied by character development. Character development is necessary for facing the challenges of an increasingly competitive 21st century. The character development in question can be supported through religious education (Zulaikha, 2019). Indonesia, as a Muslim-majority country, should have a learning approach that can provide students with aspects of spirituality. The updated 2013 curriculum put the core competency one ("Kompetensi Inti 1", furthermore KI 1 or The

First of Core Competence) assessment, namely the spiritual aspect, in religious and character lesson subjects (Kementrian Pendidikan & Kebudayaan, 2017; Damayanti, 2019). Therefore, further narrowing the flexibility of non-religious teachers to explore or connect religion with the general subject matter.

Non-religious subject teachers, for the current state of the education system, include science teachers. Science has many values of life and education, one of which is the value of religion (Sumarna, 1981; Yudianto, 2005, Widodo, 2021). Biology, as part of science, reveals various scientific phenomena that occur in the form of micromolecules to the biosphere (Campbell et al, 1999). Many books and scientific writings explore the subject matter of Biology to be linked with the verses of the Qur'an. The religion aspect is still in explicit form, which is to include verses of the Qur'an related to the subject matter of Biology (Yudianto, 2005). Meanwhile, Biology teachers, especially in Madrasahs, still have difficulty in integrating the basic learning material of Biology with verses from the Qur'an (Amri et al, 2017). KI 1 related to the religion aspect is still defined by the aspect of nurturing, maintaining, and utilizing natural resources following the religion one believed. (Kementerian Pendidikan & Kebudayaan, 2013; 2017; Agustina et al, 2020). Therefore, efforts need to be made to develop the STREAM approach by adding the religion (R) aspect to STEM and STEAM (Agustina et al, 2020). With the hope of producing a generation of scientists who are faithful, devoted, and able to build the nation's morals with a religious approach (Tafsir, 2005 in Yudianto, 2005; Poedjiadi, 2005). This approach can be a unique characteristic of the learning approach in Indonesia by adding aspects of religion to STEM or STEAM. The STREAM approach will not be found in other countries, western countries in particular. Therefore, the STREAM approach can equip students with higher-order thinking skills as well as strengthen students' faith in Allah through the learning process of Biology.

The STREAM framework, adapted from the perspective of Hsu (2014) (Figure 1). The STEM perspective is then developed into the STREAM framework, where science (S) content surrounds the intersecting aspects of technology (T), religion (R), engineering (E), arts (A), and mathematics (M). The schematic of the STREAM approach is shown in Figure 1 (Agustina et al, 2020). The science learning content mentioned in this case is about Plant Anatomy. Making plant anatomy structure models requires technological aspects, even though the technology used is simple, such as scissors, cutters, and so on. The aspect of technology that intersects with engineering is the aspect of designing work steps and plant anatomy models (anatomy models of roots, stems, and leaves). Aspects of technology and engineering that intersect with mathematics are to calculate the necessary tools and materials, along with the budget. Various research results show that creativity should be based on the principle of faith (aqidah/religion) (Al-karasneh & Saleh, 2010; Daud et al, 2012; Ismail & Shaari, 2015; Agustina et al, 2020). Thus, the aspect of art related to creativity can also intersect with religion.

The research on the STREAM approach has been carried out at an Islamic higher education institution, namely Universitas Islam Negeri Sunan Gunung Djati Bandung (Agustina et al, 2020). Islamic State University Sunan Gunung Djati Bandung has a guidance paradigm called “Wahyu Memandu Ilmu” (WMI), which means that scientific knowledge is guided by belief (in this case the teachings of Islam/religion). The purpose of the guidance paradigm is so that there is no scientific knowledge that contradicts the words of God (belief/religion) (Tafsir, 2010 in Subandi, 2010; Natsir, 2013; WMI Consortium, 2019; Agustina et al, 2020). Pre-service Biology teacher graduates from Biology Education in Islamic State University Sunan Gunung Djati are expected to conform to the “WMI” guidance paradigm. Therefore, lecturing processes are strived to always be related to the WMI paradigm. The scope of the religion aspect has a larger size than the scope of other aspects because the religion aspect is the hallmark of the university (Agustina et al, 2020).



(a) (b)

Figure 1. STEM perspective (Figure Source , Hsu, 2014) (a) The STREAM Framework (b) (Figure Source: Agustina et al, 2020)

The Department of Biology Education at Islamic State University Sunan Gunung Djati has a curriculum consisting of theory classes and practical classes (Biology Education, 2016a). The lecturing mechanism for theory class is carried out at a separate time from the practical class. The learning process using the STREAM approach has been carried out previously on the content of Applied Biology and Plant Physiology (Agustina et al, 2018; Agustina et al, 2019). Meanwhile, the STREAM approach has not yet been carried out for the contents of Plant Anatomy.

Plant Anatomy offline practicum work aims to provide skills in identifying various forms /structures of plant tissue, explaining the function of various plant tissues, and detailing the various plant tissues that make up the organs of roots, stems, leaves. Students are assigned to make two-dimensional images of various tissues of plant and tissues that make up plant organs after observing them under a microscope (Muspiroh, 2012; Practicum syllabus of Plant Anatomy or it means "Silabus Praktikum Anatomi Tumbuhan", 2016b). The Plant Anatomy lab practicum in the even semester of 2020/2021 is conducted online. The project assignment that was carried out using the STREAM approach was to create a structure model of roots, stems, and leaves. The project assignment is one of the learning methods in the Plant Anatomy lab practicum. The STREAM approach, like the STEM approach, requires an assessment in the form of an authentic assessment. Performance assessment of product project report is part of an authentic assessment (Anwari et al, 2015; Firman, 2015: Septiani, 2016; Agustina et al, 2018). In this study, a performance assessment was carried out on the product project report of the plant structure model based on the STREAM approach.

Based on this background, the study raises a research problem as follows: "How is the achievement of the science-technology-religion-engineering-arts-mathematics aspect in the Plant Anatomy project assignment?". The research questions are detailed as follows:

1. What is the strongest aspect of the STREAM approach to the project report on the Plant Anatomy structure model?
2. What is the weakest aspect of the STREAM approach to the project report on the Plant Anatomy structure model?
3. How are the achievement comparisons of the criteria in the regular class and the class that uses the STREAM approach?

The purpose of this study was to analyze the achievement of each aspect of the STREAM approach, to find out the strongest and weakest aspects of the Plant Anatomy structure model project report, and to compare the criteria achievement in the regular class and the class that uses the STREAM approach

2. RESEARCH METHODS

2.1 Research Design

The research design used in this study is the Static-Group Comparison Design (Fraenkel et al, 2012) (Figure 2). This study uses two classes as its subject, namely the regular class and the intervention class. The regular class received the project assignments without using the STREAM approach. While the intervention class is a treatment class, in which they receive the project assignments using the STREAM (X) approach. Furthermore, observations (O) were carried out on the project assignments, namely assessing the performance against project reports based on the STREAM approach. The practicum report is done by the students individually.

X	O
	O

Figure 2. The static-group comparison design (Figure Source: Fraenkel et al, 2012)

The STREAM approach, like the STEM approach, combines scientific processes and engineering design. The steps used are Think (Pikir / P), Design (Desain / D), Create (Buat / B), and Test (Uji / U) (Suwarma, 2014; Agustina et al, 2020). The students use the P-D-B-U steps in modeling the structure of Plant Anatomy. The students then identify problems in making the Plant Anatomy structure model. Problem identification can be obtained from researching various literature sources on the internet. Next, the students look for solutions to solve these problems. The details of the steps of P-D-B-U are as follows:

a. Think (P): identify the problems of making the structure model found in various literature, find solutions to the problems in making the Plant Anatomy structure model

b. Design (D): choosing the appropriate tools and materials, determining the workflow, designing said workflows, and the Plant Anatomy structure model

c. Create (B): create the plant anatomy structure model according to the previously made design

d. Test (U): analyzing and testing the product of the structure model. Testing is done by comparing the product with the previously made design. If the product does not match the design, then the students have to redesign and recreate the product.

2.2. Target Population and Research Sample

The target population of the study are 116 fourth semester students divided into three classes, namely class IV A, IV B, and IV C. Purposive sampling was carried out on the target of the fourth-semester students in class A and class C. Class IV-A is the regular class (Re) totaling 39 students. While class IV-C is the intervention class (In) totaling 38 students. Each student is assigned a project to create a structure model of Plant Anatomy. The total number of structure models of the Plant Anatomy is eight models. The plant anatomy structure models in question are dicot roots, monocot roots, dicot stems, monocot stems, unifacial leaves, bifacial leaves, isobilateral leaves, and pinophyta leaves. The method of determining the model assigned to the students is by using a random sample technique by drawing without repetition or putting the result back in the pile (Creswell, 2012). The technique was carried out to get the names of students in the upper, middle, and lower groups. Thus, the assignment is different for each student based on the results of the draw.

2.3. Research Instrument and Data Analysis

2.3.1. Research Instrument

Students are given a performance task in the form of student worksheets ("Lembar Kerja Mahasiswa", furthermore LKM). LKM is used as a guide for the project assignments. The performance task is given based on the STREAM approach. The percentage of each STREAM aspect that composes the task is presented in Figure 3. The largest percentage that composes the task is in the science aspect, which is 47% out of the task. The performance task scheme is presented in Figure 4. The scheme details each aspect of STREAM in the creation and reporting of the Plant Anatomy structure model project. Each student submits a project assignment report on the structure model of Plant Anatomy.

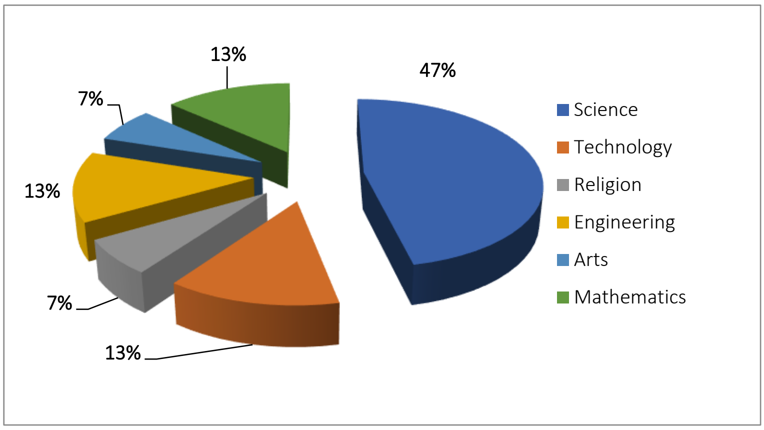


Figure 3. Pie diagram of every STREAM aspect that composes the performance task

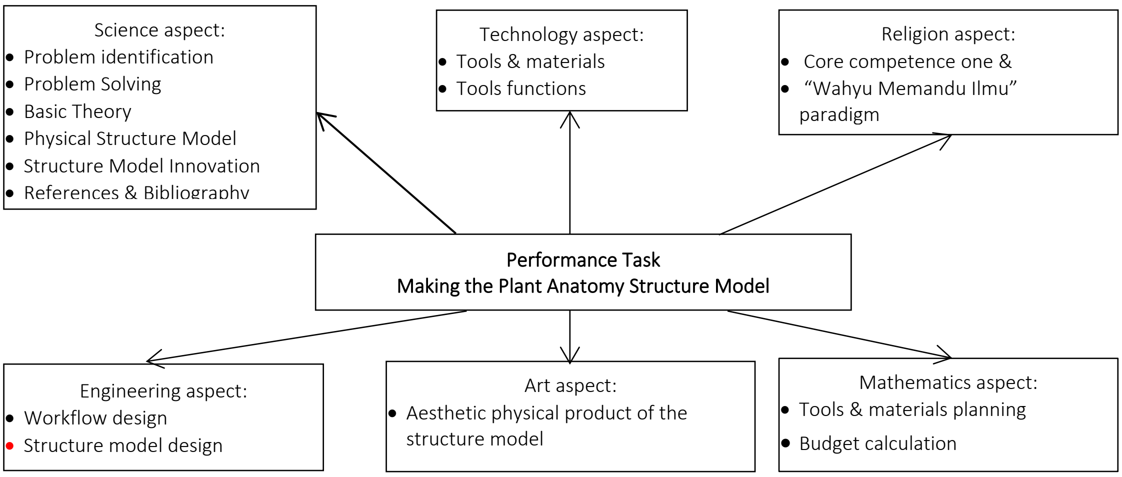


Figure 4. Students' performance task scheme

Performance assessment instruments on the project reports are carried out using an analytical rubric and 0-4 scoring. The assessment rubric for the project report of the performance task is consisted of: identifying and solving problems (Science), making theoretical basis (Science), estimating funds for the model (Mathematics), preparing tools (Technology), designing workflow drawings, and plant anatomy model (Engineering), planning the necessary for tools and materials (Mathematics), providing religious views (Religion), documenting the physical form of plant anatomy model products (Science), innovating plant anatomy model products (Science, Arts), and making a bibliography and the reference page (Science). The project reports based on the STREAM approach are specifically customized to the task. The performance assessment is carried out to measure the achievement of student skills in every aspect of the STREAM approach. Field notes during project assignments are used to record various important notes.

2.3.2. Data Analysis

Data analysis was performed by assigning a score of zero to four (0-4) on the STREAM project report based on the analytic and scoring rubric guidelines (Zainul, 2001). The example of the analytical and scoring rubrics for assessing performance on project reports is shown in Table 1. Achievement scores are shown as percentages (%) and achievement criteria for each aspect of STREAM and project reports are shown in Table 2.

Table 1. Example of the Analytical and Scoring Rubrics for Assessing Performance on Project Reports

Scoring Components	Aspect	Scoring Criteria				
	STREAM	**0**	**1**	**2**	**3**	**4**
Problem Identification	Science	Have yet to be able to give ideas in the problem-solving process	Able to give an idea even though an incorrect one	Able to give two ideas even though one may be incorrect	Able to give two ideas correctly	Able to give more than two ideas correctly
Religion aspect has two indicators, namely: a. The first Core competencies (spiritual) 2013 curriculum b. "Wahyu Memandu Ilmu" (WMI) Paradigm	Religion	Able to explain the two indicators: core competency one (being grateful, nurturing, and utilizing natural resources), and the paradigm of "Wahyu Memandu Ilmu" (for example, the creation of plants in the Qur'an).	Unable to explain the two indicators	Able to explain one of the two indicators though one may be incorrect	Able to explain the two indicators though may be incorrect	Able to explain the two indicators correctly

Table 2. Achievement Criteria on the Project Report

Achievement Percentage	Criteria
86%-100%	Excellent
76%-85%	Good
60%-75%	Sufficient
55%-59%	Fair
≤ 54%	Poor

(Source: Purwanto, 2003)

3. RESULTS AND DISCUSSIONS

3.1. Strongest Aspect

Students perform the P-D-B-U steps that are guided through the student performance task. The Think (P) step is carried out through identifying problems in making the structure models, such as through literature studies on plant cell modeling which are widely spread on the internet. The results of the literature study can then be applied to the modeling of the plant anatomy structure to solve the problems. The Design (D) step is where students determine the tools and materials needed and are available around them, such as scissors, rulers, straws, magazines, unused woods, and so on. The students also design the workflow in making the structure model and then draw said workflow to design the structure model based on credible reference sources. Adding colors to the image is also done so that the product is more attractive as long as it is still adjusted to the reference source. The Create (B) step is where the students make the structure model according to the design drawing. The Test (U) step is carried out through testing the structure model product with the previously-made design drawing. If there is a physical difference between the product and the design, then the students have to redesign and revise the product. Students write down the implementation of the P-D-B-U steps in the form of a Plant Anatomy project report. The results of the assessment are presented in Figure 5.

The results showed that the aspect that had the strongest achievement in the intervention class (In) was the engineering aspect which reached 100% under the "excellent" criteria. Meanwhile, the regular class reached 64.10% with the "sufficient" criteria in the engineering aspect (Figure 6). The engineering aspect is a systematic and creative skill in applying the principles of science and mathematics into real practice This skill is useful for creating or constructing something new such as a product (Hanover Research, 2011; Zollman, 2012; Sciencebuddies, 2014). This study assesses students' skills in designing and developing plant anatomy models into a plant anatomy structure product. Figure 6 shows an example of the engineering aspect, where the students designed a Leaf Anatomy structure model. The results of previous studies also showed that the highest improvement is in the engineering aspects under the same approach for learning content of composting and aquaponics in the Plant Physiology practicum (Agustina et al, 2018).

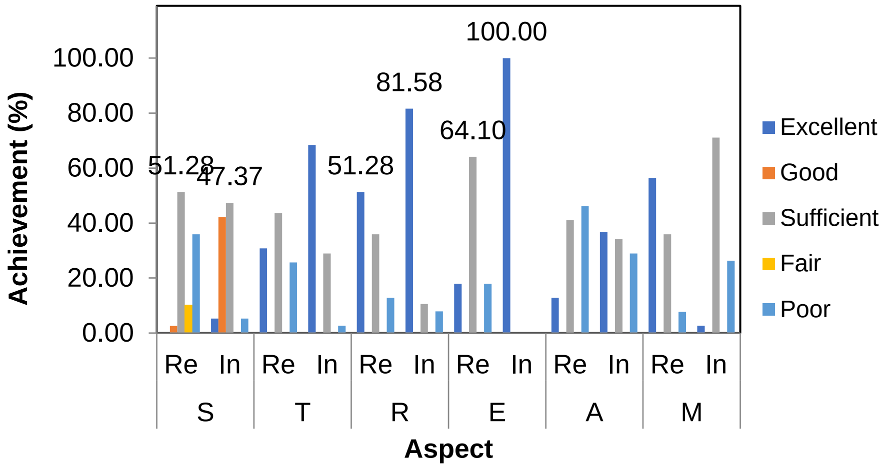


Figure 5. Bar Chart of Achievement of Each STREAM Aspect in the Regular Class (Re) and the Intervention Class (In)

The results of the field notes showed that students encountered problems when designing the structure model. This is because it is difficult to find literature sources and also because assignments are carried out individually. In pandemic conditions, lectures are automatically conducted online and students cannot conduct discussions and group work offline. Thus, project assignments are done individually by students.

The STREAM approach, like the STEM approach, places more emphasis on the design process (engineering) rather than on the scientific process. Design skills are demonstrated through design and if failure is found, then the design must be redone (Sciencebuddies, 2014; Suwarma, 2014; Agustina et al, 2019). The design skills taught to the students are expected to provide benefits to all students and the general public in the future. After all, designing skills are the job of an engineer. Similar to the story of Salman al Farisi who produced a trebuchet on the orders of the Prophet Muhammad SAW. Trebuchet is an ancient cannon, a type of launcher, that is used as a weapon used by Muslims at that time to conquer enemy fortifications (Martasyabana, 2017). The production of trebuchet technology requires a prior design or draft. Therefore, it is imperative that engineering skills have to be mastered by the Muslim generation, especially to build a noble civilization.

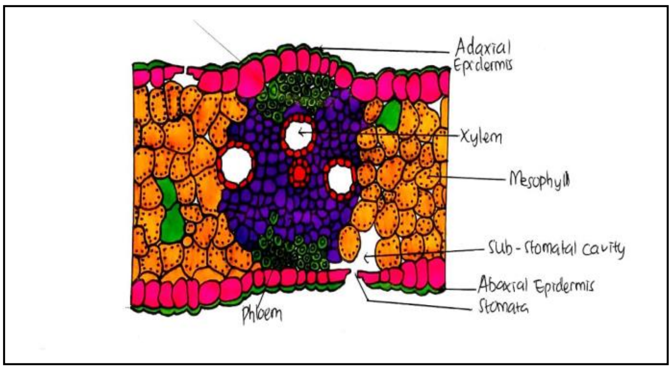


Figure 6. Sample Design of Plant Anatomical Structure Model (Leaf Anatomy) Made by Students

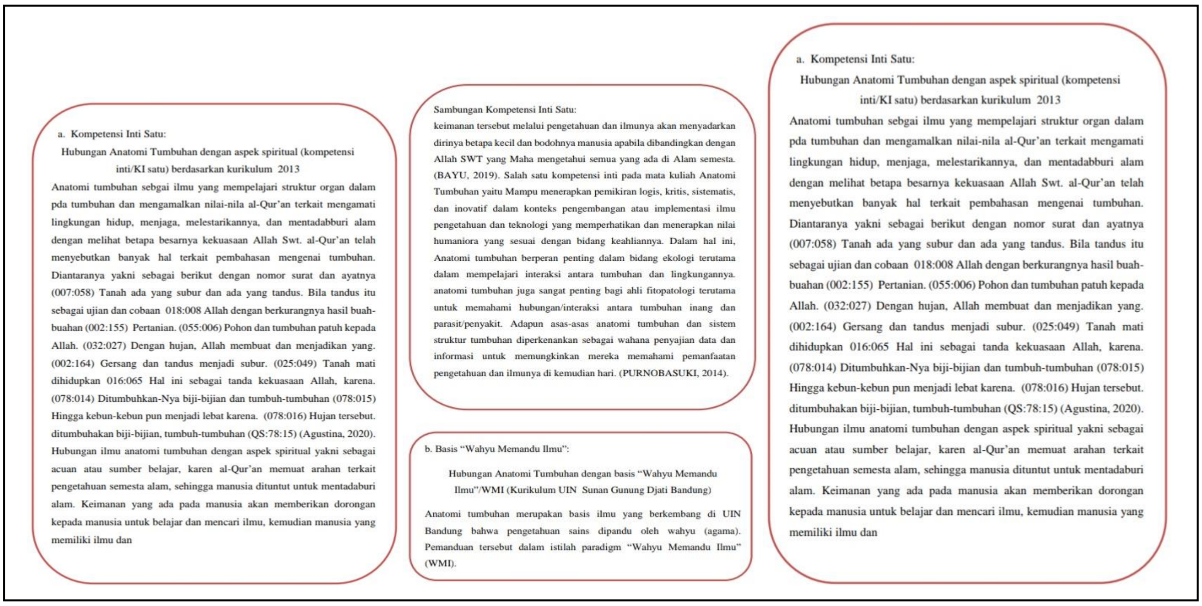
The second strongest aspect in the intervention class is the religion which reaches 81.58% of the "excellent" criteria. The reaches 51.28% of the "excellent" criteria in the regular class. The religion aspect is a unique aspect and can not be found in the STEM or STEAM approach in western countries. Our national education system demands us to develop a generation of faith and piety, as stated in the 2003 National Education System Law (Departemen Pendidikan Nasional, 2003). Learning science can encourage the belief that everything is God's creation and belongs to God, so that we, humans, have a duty to nurture, maintain, and utilize natural resources for the prosperity of all (Poedjiadi, 2005; Kementrian Pendidikan & Kebudayaan, 2013; 2017). The science referred to in this case is Plant Anatomy. Science and religion cannot be separated.

Religion is a system of belief and faith in the existence of something absolute beyond human capabilities (Lawson, 1995; Yudianto, 2005: Toharudin et al, 2011; Agustina et al, 2020). The approach used in the religion aspect is a non-scientific approach that does not use the steps of the scientific method (Ismail, 1993; Toharudin et al, 2011). The truth of religion is certain and absolute, based on faith (Lawson, 1995; Yudianto, 2005: Toharudin et al, 2011).

Science is obtained through experimentation, investigation, and human thought processes to find relationships among many observed phenomena. The truth of science is relative as it may change with the creativity of the scientists in investigating the problem (Ismail, 1993; Lawson, 1995; Toharudin et al, 2011). If a human being can understand religion and science properly, then the human will not contradict (dichotomize) between the two (Yudianto, 2005; Toharudin et al, 2011). Aspects of religion can have two indicators, namely core competence one (KI 1) and the paradigm of "Wahyu Memandu Ilmu". The example of a framework for the aspect of religion is presented in Table 3. The sample of the religion aspect made by students in a project report is presented in Figure 7.

Table 3. Example of a framework for religion aspects in a plant anatomy structure model

Indicator	Description
The first of Core Competence / KI 1	1. Appreciating and understanding the teachings of Islam: nurturing the natural resources given by Allah, is to take care of plants which are composed of roots, stems, and leaves. The anatomical structure that composes plants can be dermal tissue, ground tissue, and vascular tissue (Fahn, 1995; Hidayat, 1995). Each organ has its characteristics with different forms of tissue and derivatives. These characteristics can be associated with each function, for example, the shape of the parenchyma tissue in the leaves (mesophyll) is different from the shape of the tissue in the stem. Plants are nurtured to optimize the function of each tissue so that its growth and development can be optimal. 2. Practicing the teachings of Islam: showing gratitude to Allah for the available natural resources in the form of plants that can be utilized by animals and humans as producers/autotrophs in the food chain. Plants as a place to live and protect various microorganisms and animals, that can also be used for other needs, such as wood from xylem vascular tissue to make buildings or furniture. 3. Living the teachings of Islam (implementing, applying, conducting, communicating): students identify and distinguish the various tissues that makeup roots, stems, and leaves through Plant Anatomy lectures. Then, students make a structure model of the plant anatomy, which can be in the form of roots, stems, or leaves. The model is expected to be re-used as a learning medium for their students when they become teachers at school.
“Wahyu Memandu Ilmu” Paradigm	Many verses of the Qur'an generally tell about plants, for example, Q.S. An-Naba: 14-15 reads “And (He) have sent down from the rainy clouds abundant water, Thereby to produce grain and plant,” (Departemen Agama, 2005). The process of seed germination assisted by water is part of plant growth (Yudianto, 2005). Growth involves meristem tissue that is actively dividing. Meristematic tissue will differentiate into mature (permanent) tissue. Permanent tissues include dermal tissue (epidermis), ground tissue (parenchyma, collenchyma, sclerenchyma), and vascular tissue (xylem and phloem). The existence of these tissues make up the structure of vascular plant anatomy (Fahn, 1995; Hidayat, 1995)



a. Kompetensi Inti Satu:

Hubungan Anatomi Tumbuhan dengan aspek spiritual (kompetensi inti/KI satu) berdasarkan kurikulum 2013

Anatomi tumbuhan sebgai ilmu yang mempelajari struktur organ dalam pda tumbuhan dan mengamalkan nilai-nila al-Qur'an terkait mengamati lingkungan hidup, menjaga, melestarikannya, dan mentadabburi alam dengan melihat betapa besarnya kekuasaan Allah Swt. al-Qur'an telah menyebutkan banyak hal terkait pembahasan mengenai tumbuhan. Diantaranya yakni sebagai berikut dengan nomor surat dan ayatnya (007:058) Tanah ada yang subur dan ada yang tandus. Bila tandus itu sebagai ujian dan cobaan 018:008 Allah dengan berkurangnya hasil buah-buahan (002:155) Pertanian. (055:006) Pohon dan tumbuhan patuh kepada Allah. (032:027) Dengan hujan, Allah membuat dan menjadikan yang. (002:164) Gersang dan tandus menjadi subur. (025:049) Tanah mati dihidupkan 016:065 Hal ini sebagai tanda kekuasaan Allah, karena. (078:014) Ditumbuhkan-Nya biji-bijian dan tumbuh-tumbuhan (078:015) Hingga kebun-kebun pun menjadi lebat karena. (078:016) Hujan tersebut. ditumbuhakan biji-bijian, tumbuh-tumbuhan (QS:78:15) (Agustina, 2020). Hubungan ilmu anatomi tumbuhan dengan aspek spiritual yakni sebagai acuan atau sumber belajar, karen al-Qur'an memuat arahan terkait pengetahuan semesta alam, sehingga manusia dituntut untuk mentadaburi alam. Keimanan yang ada pada manusia akan memberikan dorongan kepada manusia untuk belajar dan mencari ilmu, kemudian manusia yang memiliki ilmu dan

Sambungan Kompetensi Inti Satu:

keimanan tersebut melalui pengetahuan dan ilmunya akan menyadarkan dirinya betapa kecil dan bodohnya manusia apabila dibandingkan dengan Allah SWT yang Maha mengetahui semua yang ada di Alam semesta. (BAYU, 2019). Salah satu kompetensi inti pada mata kuliah Anatomi Tumbuhan yaitu Mampu menerapkan pemikiran logis, kritis, sistematis, dan inovatif dalam konteks pengembangan atau implementasi ilmu pengetahuan dan teknologi yang memperhatikan dan menerapkan nilai humaniora yang sesuai dengan bidang keahliannya. Dalam hal ini, Anatomi tumbuhan berperan penting dalam bidang ekologi terutama dalam mempelajari interaksi antara tumbuhan dan lingkungannya. anatomi tumbuhan juga sangat penting bagi ahli fitopatologi terutama untuk memahami hubungan/interaksi antara tumbuhan inang dan parasit/penyakit. Adapun asas-asas anatomi tumbuhan dan sistem struktur tumbuhan diperkenankan sebagai wahana penyajian data dan informasi untuk memungkinkan mereka memahami pemanfaatan pengetahuan dan ilmunya di kemudian hari. (PURNOBASUKI, 2014).

b. Basis "Wahyu Memandu Ilmu":

Hubungan Anatomi Tumbuhan dengan basis "Wahyu Memandu Ilmu"/WMI (Kurikulum UIN Sunan Gunung Djati Bandung)

Anatomi tumbuhan merupakan basis ilmu yang berkembang di UIN Bandung bahwa pengetahuan sains dipandu oleh wahyu (agama). Pemanduan tersebut dalam istilah paradigm "Wahyu Memandu Ilmu" (WMI).

a. Kompetensi Inti Satu:

Hubungan Anatomi Tumbuhan dengan aspek spiritual (kompetensi inti/KI satu) berdasarkan kurikulum 2013

Anatomi tumbuhan sebgai ilmu yang mempelajari struktur organ dalam pda tumbuhan dan mengamalkan nilai-nila al-Qur'an terkait mengamati lingkungan hidup, menjaga, melestarikannya, dan mentadabburi alam dengan melihat betapa besarnya kekuasaan Allah Swt. al-Qur'an telah menyebutkan banyak hal terkait pembahasan mengenai tumbuhan. Diantaranya yakni sebagai berikut dengan nomor surat dan ayatnya (007:058) Tanah ada yang subur dan ada yang tandus. Bila tandus itu sebagai ujian dan cobaan 018:008 Allah dengan berkurangnya hasil buah-buahan (002:155) Pertanian. (055:006) Pohon dan tumbuhan patuh kepada Allah. (032:027) Dengan hujan, Allah membuat dan menjadikan yang. (002:164) Gersang dan tandus menjadi subur. (025:049) Tanah mati dihidupkan 016:065 Hal ini sebagai tanda kekuasaan Allah, karena. (078:014) Ditumbuhkan-Nya biji-bijian dan tumbuh-tumbuhan (078:015) Hingga kebun-kebun pun menjadi lebat karena. (078:016) Hujan tersebut. ditumbuhakan biji-bijian, tumbuh-tumbuhan (QS:78:15) (Agustina, 2020). Hubungan ilmu anatomi tumbuhan dengan aspek spiritual yakni sebagai acuan atau sumber belajar, karen al-Qur'an memuat arahan terkait pengetahuan semesta alam, sehingga manusia dituntut untuk mentadaburi alam. Keimanan yang ada pada manusia akan memberikan dorongan kepada manusia untuk belajar dan mencari ilmu, kemudian manusia yang memiliki ilmu dan

Figure 7. Examples of religion aspects in student project reports

3.2. Weakest Aspect

The art aspect is the weakest in both classes. The art aspect is related to creativity. This is in line with the results of research on Applied Biology content which shows that the art aspect of students is still weak (Agustina et al, 2019). Science, in this case, Plant Anatomy, and art have opposite areas. Science emphasizes rational aspects and logical thinking, while art is more about aesthetics. However, to connect science and art, creativity needs to be used as a bridge between science and art (Kind & Kind, 2007).

Meanwhile, creativity, in the perspective of Islam, has to relate to the principles of Islamic aqidah (Al-karasneh and Saleh, 2010; Daud et al, 2012; Ismail & Shaari, 2015; Agustina et al, 2020). Therefore, the art aspect must be following the rules of Allah SWT and following the sunnah of the Prophet Muhammad SAW. Thus, it is important to equip students with creativity to support arts in science learning following Islamic principle.

3.3. Comparison of Criteria in the Intervention Class (In) and the Regular Class (Re)

Table 4 shows that the achievement of percentages and criteria in the intervention class showed better results than the regular class. In the regular class, the achievement of the criteria varies from "good" to "poor", most of the achievements are in the criteria of "sufficient". Meanwhile, in the intervention class, the achievement is between the criteria of "excellent" to "sufficient". Most of the students achieved the "good" criteria.

This shows that the STREAM approach can provide optimal results in student project reports. Project report based on the STREAM approach is combined with scientific processes. The scientific process requires higher-order thinking skills (HOTS). HOTS are part of the habits of mind. The results of another study show that the STREAM approach can equip students' thinking habits on the learning content of Applied Biology (Agustina et al, 2020).

Table 4. Comparison of Achievement Criteria in Both Classes

Criteria	Regular Class (Re) (%)	Intervention Class (In) (%)
Excellent	0.00	15.79%
Good	28.21	60.53
Sufficient	61.54	23.68
Fair	5.13	0.00
Poor	5.13	0.00

4. CONCLUSION

The strongest aspect in the intervention class, namely the engineering aspect, reached 100% of the "excellent" criteria. The weakest aspect in both classes is the art aspect with varying criteria. The results of the comparison of achievement criteria show that the intervention class, which uses the STREAM approach, provides better achievement results than the regular class.

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REFERENCES

Agustina, T.W., Rustaman, N.Y., Riandi, & Purwianingsih W. (2018). Plant Physiology with Mathematic and Art Religion Engineering Science and Technology Approach. *Advances in Social Science, Education and Humanities Research, 261*, 43-47.

Agustina, T.W., Rustaman, N.Y., Riandi, & Purwianingsih W. (2019). Program Pembekalan Keterampilan Berpikir Sistem dan Kreativitas Biologi Terapan (BIORE) Menggunakan Pendekatan Science-Technology-Religion-Engineering-Arts-Mathematics (STREAM). *Dissertation*. Bandung: School of Postgraduate Studies, Indonesian Education University.

Agustina, T.W., Rustaman N.Y., Riandi, & Purwianingsih, W. (2020). Pendekatan STREAM (Science-Technology-Religion-Engineering-Arts-Mathematics) Membekalkan Kebiasaan Berpikir Mahasiswa. *Edusains*, 12 (2), 283-296.

Al-karasneh, S.M., & Saleh, A.M.J. (2010). Islamic perspective of creativity: A model for teachers of social studies as leaders. *Procedia Social and Behavioral Sciences*, *2*, 412–426.

Amri, N.D., Rasyidi, Al., & Imran, A. (2017). Integrasi Nilai-nilai KeIslaman dalam Pembelajaran Biologi di SMA Islam Al-Ulum Terpadu Medan. Edu-Riligia, *1*(4), 487-500.

Anwari, I., Yamada, S., Unno, M., Saito, T., Suwarma, I.R., Mutakinati, L. & Kumano, Y. (2015). Implementation of Authentic Learning and Assessment through STEM Education Approach to Improve Students Metacognitive Skills. *K-12 STEM Education, 1*(3), 123-136.

Basham, J.D., & Marino, M.T. (2013). Understanding STEM Education and Supporting Students Through Universal Design for Learning. *Teaching Exceptional Children, 45*, 8-15.

Bybee, R.W. (2010). Advancing STEM Education: A 2020 Vision. *Technology and Engineering Teacher, 70*(1), 30-35. https://eric.ed.gov/ ?id=EJ898909.

Campbell, N.A., Reece, J.B., & Mitchell, L.G. (1999). *Biologi*. Jakarta: Erlangga.

Conradty C. & Bogner, F. X. (2019). From STEM to STEAM: Cracking the code? How creativity & motivation interact with inquiry-based learning. *Creativity Research Journal*, *31*(3), 284–295.

Creswell, J.W. (2012). *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*. Boston: Pearson.

Damayanti (2019). *Modul Pendalaman Pedagogik Program Profesi Guru Pendidikan Agama Islam: Teori-teori Belajar dan Pembelajaran*. Jakarta: Pendidikan Agama Islam Kementrian Agama.

Daud, A.M., Omar, J., Turiman, P., & Osman, K. (2012). Creativity in Science Education. *Procedia - Social and Behavioral Sciences*, *59*, 467-474.

Departemen Agama (2005). *Al-Qur'an dan Terjemahan*. Jakarta: Departemen Agama Republik Indonesia.

Departemen Pendidikan Nasional. (2003). *Undang-undang Republik Indonesia No 20 tentang Sistem Pendidikan Nasional*, 1-26. https://luk.staff.ugm.ac.id.

Fahn, A. (1995). *Anatomi Tumbuhan*. Yogyakarta : Gadjah Mada University Press.

Firman, H. (2015). Pendidikan Sains Berbasis STEM: Konsep, Pengembangan, dan Peran Riset Pascasarjana. *Seminar Nasional Pendidikan IPA dan PKLH*. Bogor, 1-9. https://www.academia.edu.

Fraenkel, J.R., Wallen, N.E., & Hyun, H.H. (2012). *How to Design and Evaluate Research in Education*. New York: McGraw-Hill.

Hanover Research (2011). *K-12 STEM Education Overwiew*. 1-20. https://www.hanoverresearch.com.

Henriksen, D. (2014), Full STEAM Ahead: Creativity in Excellent STEM Teaching Practices, *The STEAM Journal*, *1*(2), 1-7.

Hidayat, E.B. (1995). *Anatomi Tumbuhan Berbiji*. Bandung : Penerbit ITB.

Hsu. (2014). *The perspective of STEM*. https://perspectivestemeducation.comservices.html.

Ismail, M. (1993). *Bunga Rampai Pemikiran Islam*. Jakarta: Gema Insani Press.

Ismail, S. & Shaari, M.S. (2015). Fostering Creativity in The Islamic World: Towards An Effective Islamic Creative Industry. *Indian Journal of Arts,* 5 (16), 111-119.

Jho, H., Hong O., & Song, J. (2016). An Analysis of STEM/STEAM Teacher Education in Korea with A Case Study of Two Schools from A Community of Practice Perspective. *Eurasia Journal of Mathematics, Science and Technology Education*, *12*(7), 1843-1862.

Kementrian Pendidikan & Kebudayaan (2013). *Kurikulum 2013 Kompetensi Dasar Sekolah Menengah Atas (SMA)/ Madrasah Aliyah (MA).* Jakarta: Kementrian Pendidikan dan Kebudayaan.

Kementrian Pendidikan & Kebudayaan (2017). Model Silabus Mata Pelajaran Sekolah Menengah Pertama/Madrasah Tsanawiyah (SMP/MTs) Mata Pelajaran IPA. Jakarta: Kementrian Pendidikan & Kebudayaan.

Kind, P.M., & Kind, V. (2007). Creativity in Science Education: Perspectives and Challenges for Developing School Science. *Studies in Science Education*, *43*(1), 1-37.

Lawson, A.E. (1994). *Science Teaching and Development Thinking*. California: Wadsworth Publishing Company.

Martasyabana, I. (2017). *Manjaniq dan Dabbabah di Masa Perang Thaif*. https://wartapilihan.com.

Muspiroh, N. (2012). Analisis Kemampuan Generik Sains Mahasiswa Calon Guru Biologi Pada Praktikum Anatomi Tumbuhan. *Jurnal Scientiae Educatia, 1*(1),1-15.

Natsir, M. (2018). *Prodi STEM masih jadi Tumpuan Pemerintah Tingkatkan SDM Indonesia*. https://www.pikiranrakyat.com

Natsir,N.F.(2013). *Paradigma Wahyu Memandu Ilmu dalam Pembidangan Ilmu-Ilmu Keislaman*. https://www.uinsgd.ac.id.

Nurlenasari, N., Lidinilah, D.A.M., Nugraha, A., & Hamdu, G. (2019). Assessing 21st-century skills of the fourth-grade student in STEM learning. *Journal Physic.: Conference Series, 1318*, 1-7.

Oner A.T., Nite S.B., Capraro R.M., & Capraro M.M. (2016) From STEM to STEAM: Students' Beliefs About the Use of Their Creativity. *The STEAM Journal*, *2*(2), 1-16.

Partnership for 21st Century Skills (2007). *The road to the 21st century: A policymaker's guide to 21st-century skills*, 1-9. HTTP:// p21.org/tools-and-resources/ publications/925.

Pendidikan Biologi UIN Bandung (2016a). *Kurikulum Program Studi Pendidikan Biologi*. Bandung: Fakultas Tarbiyah dan Keguruan.

Pendidikan Biologi UIN Bandung (2016b). *Silabus Praktikum Anatomi Tumbuhan*. Bandung: Fakultas Tarbiyah dan Keguruan.

Poedjiadi, A. (2005). *Pendidikan Sains dan Moral Bangsa*. Bandung: Yayasan Cendrawasih.

Purwanto, N. (2003). *Prinsip-prinsip dan Teknik Evaluasi Pengajaran.* Bandung: Remaja Rosdakarya

Ridwan, A., Rahmawati, Y. & Hadinugrahaningsih, T. (2017). STEAM Integration in Chemistry Learning for Developing 21st Century Skills. *MIER Journal of Educational Studies, Trends & Practices*, 7(2), 184-194.

Sciencebuddies (2014). *Comparing The Engineering Design Process and The Scientific Method.* https://www.sciencebuddies.org.

Septiani, A. (2016). Penerapan Asesmen Kinerja Dalam Pendekatan STEM Untuk Mengungkap Keterampilan Proses Sains. *Isu-Isu Kontemporer Sains, Lingkungan dan Inovasi Pembelajarannya*, 654-659. https://publikasiilmiah.ums.ac.id.

Subandi, H.M. (2010). *Mikrobiologi, Perkembangan, Kajian, dan Pengamatan dalam Perspektif Islam*. Bandung: PT. Remaja Rosdakarya.

Sumarna, A. (1981). Nilai-nilai dalam IPA', dalam *Mata Kuliah Dasar Umum Ilmu Alamiah Dasar*. Bandung : Institut Keguruan dan Ilmu Pendidikan.

Suwarma, I. R. (2014). A Research on STEM Education Theory and Practices Method in Japan and Indonesia Using Multiple Intelligence Approach. *Doctoral Thesis*. Shizuoka University.

Toharudin, U., Hendrawati, S., & Rustaman, A. (2011). *Membangun Literasi Sains Peserta Didik*. Bandung: Humaniora.

Widodo, A. (2021). *Pembelajaran Ilmu Pengetahuan Alam Dasar-dasar Untuk Praktik*. Bandung: Universitas Pendidikan Indoensia Press.

Wijaya, A.D., Karmila N., & Amalia M.R. Implementasi Pembelajaran Berbasis STEAM (Science, Technology, Engineering, Art, Mathematics) pada Kurikulum Indonesia (2015). *Seminar Nasional Fisika dan Aplikasinya*, *Universitas Padjadjaran,* 85-88. https: Portal.Phys.unpad.ac.id

WMI Consortium. (2019). Irawan *et al* (*eds*.). *Pengantar Wahyu Memandu Ilmu*. Jakarta: PT Rajagrafindo Persada.

Yudianto, S.A. (2005). *Manajemen Alam (Sains) Sumber Pendidikan Nilai*. Bandung: Mughni Sejahtera.

Zainul, A. (2001). *Alternative Assesment.* Universitas Terbuka: Jakarta.

Zollman, A. (2012). Learning for STEM Literacy: STEM Literacy for Learning. *School Science and Mathematics*, *112*(1), 12-19.

Zubaidah, S. (2019). STEAM (Science, Technology, Engineering, Arts, and Mathematics): Pembelajaran untuk Memberdayakan Keterampilan Abad ke-21. *Conference Paper: Seminar Nasional Matematika dan Sains, Universitas Wiralodra Indramayu*. 1-19. https://www.researchgate.net.

Zulaikha, S. (2019). Penguatan Pendidikan Karakter Melalui Pendidikan Agama Islam di SMPN 3 Bandar Lampung. Al-Tadzkiyyah: Jurnal Pendidikan Islam, *10*(1), 83-93.