Studies in Philosophy of Science and Education
Homepage: https://scie-journal.com/index.php/SiPoSE
Email: sipose@scie-journal.com

p-ISSN: 2722-3523; e-ISSN: 2721-9267
SiPoSE, Vol. 1, No. 3, December 2020: 97-103

The Novelty of Religion and Art: Should We Combine with STEM Education?

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Article Info

Article history:

Received November 14, 2020
Revised November 30, 2020
Accepted December 5, 2020
Available Online December 6, 2020

Keywords:

STREAM
STEAM
Education
Science
Technology

ABSTRACT

One of the meaningful learning implications is the formation of Long-Term Memory (LTM). Through the development of concepts related to the problems of everyday life that bridge LTM and the implementation of Science, Technology, Engineering and Mathematics (STEM) as an educational approach, it enables students to realize the importance of knowledge for society. However, some aspects of society are excluded from STEM, in that way a transformation needs to be carried out. Art and Religion need to be developed in STEM to nurture students, environment, and society to the full. Several examples are presented to represent the relationship between STEM with art and religion, not only in terms of learning outcomes in schools, but also the expectations to create resilient people in facing the future challenges. With Science, Technology, Religion, Engineering, Art, and Mathematics (STREAM) education approach.

https://doi.org/10.46627/sipose

INTRODUCTION

Science, Technology, Engineering, and Mathematics (STEM) in educational purpose has been the solution of the 21st Century Learning challenge. STEM education came up as the answer to realize students are part of social life (Kelley & Knowles, 2016). This vision consists of the pragmatism that concept should be enacted to real life and see how to concept make sense (Riga, 2020). As a further challenge, a concept can be interacting with the environment. Hence, for that interaction, we change it, are changed by it, and know the new fact about detailed information. When a person communicates to others, he transfers not only his view but also the approach of the view modifies to integrate the harmonize response. By continuing to interact with the environment, the way of thinking is formed in every individual. That mindset is unique, can't be formed by repetition, and meaningful in every single information relating to the concept. In the long term, it alters habit due to the effect of that concept to the person.

Relating to pragmatism, social constructivism believes that the concept development is the combination between spontaneous and scientific concepts (Taber, 2020). It means, for developing the concept need social life as the spontaneous aspect and previous-relating information as the scientific thing. However, the previous-relating information as the scientific doesn't mean the absolutely true for this approach. The different assumptions of previous information are precisely the bridge for the long term memory (LTM). As to the impact of social interaction and to learning purpose applications, LTM keeps the information in a long duration

(Suyono & Hariyanto, 2011). So, it will be the positive impact of the learning process as the meaningful process.

As the activity encapsulated in learning referred to as inquiry-based education, has various styles. The main process of the inquiry to believe that the problem is inspected and resolved by various actions. Morgan described the inquiry of Dewey of five steps: Problem Recognition, Problem identification, Problem-solving design, Evaluation, and Taking Action (Morgan, 2014). After more, STEM education is the best way to state inquiry because of the characteristic in problem-solving.

In reality, social life covers art and religion. In Indonesia, culture as part of art has a powerful aspect in education, and also religion takes many important parts in education. The values of both are essential to be implemented in formal education. As the aspect in Pragmatism, religion and art take an important mindset of the learner. Many beliefs on learning relating to the formal or even scientific concept. For this first phenomena, adding art and religion is the consequence of the social immerge in education and the novelty of that integration bravely explained.

METHODS OF WRITING

The method of writing in this editorial utilized a position paper (Abdul Razzak, 2020; Abidah et al., 2020). A position paper aims to persuade the reader that our opinion is useful and defensible (Abidah et al., 2020). The authors would like to propose the concept of Religion to complete the existence of STEM and STEAM established previously. This idea supported the development of Studies in Philosophy of Science and Education as an international journal (Suprapto et al., 2020).

RESULTS AND DISCUSSION

A. STEM

The STEM approach in education has received increasing attention over the last decade with calls for greater emphasis on all four areas for improvement of curriculum and teaching quality (Honey, Pearson, & Schweingruber, 2014). Many countries applied the STEM approach in their education curriculum. For example, Taiwan was integrating the STEM curriculum in problem-based learning (Lou, 2010). Turkey was developing STEM Competencies Assessment to make frameworks of assessment on interdisciplinary better (Arikan, 2020). Moreover, the United State prepared 100,000 new teachers in the fields of science, technology, engineering, and math (The White House, 2011).

From the fourth of STEM components, the National Research Council (NRC) of the United States was describing the meaning of each part: (NRC, 2014; Honey, Pearson, & Schweingruber, 2014)

- **Science** is the study of the natural world, including the laws of nature associated with physics, chemistry, and biology and the treatment or application of facts, principles, concepts, or conventions associated with these disciplines.
- **Technology**, while not a discipline in the strictest sense, comprises the entire system of people and organizations, knowledge, processes, and devices that go into creating and operating technological artifacts, as well as the artifacts themselves.
- **Engineering** is both a body of knowledge about the design and creation of human-made products and a process for solving problems.
- **Mathematics** is the study of patterns and relationships among quantities, numbers, and space. Unlike in science, where empirical evidence is sought to warrant or overthrow claims, claims in mathematics are warranted through logical arguments based on foundational assumptions. The logical arguments themselves are part of mathematics along with the claims.

Through the integration of four components, namely science, technology, engineering, and mathematics, as a learning approach, it will elevate the educational system in a positive trend.

Students can develop their skills with the STEM approach, including problem-solving, critical analysis, teamwork, independent thinking, initiative, and digital literacy. The continual advances in technology are changing the way students learn, connect, and interact every day. Students' skills through STEM provide them with the foundation to succeed at school and beyond (White, 2014).

B. STEAM

STEM is a powerful approach in the learning activity, especially in mathematics, science, and engineering. However, several subjects can't be covered using this approach, such as language, design, music, transdisciplinary, etc. (Guyotte et al., 2014; Rolling, 2016; Good, Bourne, & Drake, 2020). As we know, STEM education not only applies in the formal school, but also attempts to educate more conscious youth with the high-tech skills to expand the STEM job market. Therefore, the new initiation is needed to cover the higher-tech skills in huge aspects. According to the National Art Education Association (NAEA, 2019), to achieve high-quality education and high-tech students' skills, visual arts content and artistic thinking must be the basic components and have to be combined with STEM. With the inclusion of an art component in STEM become STEAM (Science, Technology, Engineering, Art, and Mathematics) is an effort to provide a balance to the student's personality, namely individuals with intellectual, sharp feelings, and efficient performance, which can be seen in ethical-aesthetic-artistic behavior (Sutrisno & Verhaak, 1993). On one side, aesthetic attitude can sharpen effective potential, and on the other hand it can stimulate the growth of creativity which is a vital element in shaping character and personality (Prabowo, 2007).

The STEAM educational approach supports experiential learning, creativity, problem-solving skills, and argues that science, technology, engineering, art, and mathematics are interrelated. Students are encouraged to take risks, think critically, and find creative solutions to problems (Liao, 2016). In the STEAM approach, there is no isolated subject. Science and technology can be interpreted through art and engineering, as well as incorporating mathematical and science components, students work together and inspire one another. With the complex systems and solutions are conceptualized and designed by analytical skills, it will increase the ability of students (Land, 2013).

The art aspect not only makes science beautiful, but also makes technology more aesthetic (Root-Bernstein, 2011). Several studies and technology products have been approved on the importance of art in STEM. For example, research conducted by Swaminathan & Schellenberg (2015) shows that learning arts can improve students' cognitive skills such as spatial reasoning, abstract thinking, divergent thinking, self-creativity, openness to experience, and curiosity. Other examples in technology products are an electronic display screen that uses a combination of red, blue, and green dots to produce all the different colors. Second, computer chips are made using a combination of three classical artistic inventions, namely etching, silk screen printing, and photolithography (Daugherty, 2013). Therefore, by applying the STEAM approach to formal or non-formal education, students will be able to acquire high technology skills from an early age and achieve higher quality education.

C. STREAM

As previously described, the STEM and STEAM are the powerful education approach to achieve higher quality education. However, in Indonesia, inserting the art component in STEAM is not enough. Because religion takes many essential parts in Indonesia education, there have been an urge to create correlation between religion and science, as Einstein stated that science without religion is blind, religion without science is lame. Only when merged with a secular worldview science is against religion (Padgett, 2005). Moreover, if there is any dispute about the basic view between science and religion, it can lead to cognitive dissonance. The implication of cognitive dissonance is people have trouble reconciling or understanding seemingly contradictory moral systems or pieces of knowledge (McMorris, 2016).

A dialectic between science and religion needs to be developed to avoid cognitive dissonance. STREAM acts as a means of establishing a dialectic between science and religion. STREAM is a learning approach that incorporates the science, mathematics, the use of technology, engineering, and integrated with the aspects of religion and art (Agustina et al., 2018). Different approaches will produce different results. STREAM is expected to be able to connect humans, environment, and society with God.

As science develops, the transformation of religious education needs to be carried out in the 4.0 era, which has been extensively discussed in higher education (Muslih, 2018). STREAM development may provoke metacognitive skill which allows individuals to consciously think about a problem, choose suitable strategies, and make decisions about a course of action to solve a problem or execute a task successfully (Padhmasari, 2016; TEAL Center staff, 2011). STREAM advances to fulfil those needs.

Indonesia as a predominantly Muslim country, has developed religious education before formal education. Knowledge in Islam does have no boundaries and there is no dichotomy. *Adab* of knowledge (*adabul 'Ilm*) does not only about receiving knowledge but also applies and shares it. In that way, a Muslim has a responsibility to get and use his knowledge for solving problems. Practically, a Muslim uses science, mathematics, technology, engineering, and art on his religious activity. Such as to determine prayer time, analyze moon position, understanding the Quran, transportation, calculate zakat, etc.

One educational institution that attempts to integrate religion in its learning is Trensains, both in Sragen, Central Java and in Jombang, East Java. Maksudin stated that Trensains is an educational institution that combines school and *pesantren* (indigenous Islamic education system) in one system. The main idea is to collaborate the Quran (*qauniyah* verses), science, and linguistics (Shalihin et al., 2019). The founder of Trensains, Prof. Agus Purwanto, named that unification curriculum by *Kurikulum Semesta* (Muslih, 2018).

The program in *Kurikulum Semesta* that represented of *qauniyah* verses is a laboratory of *Ayat-Ayat Semesta* and Science Project. Both programs are executed outside the classroom (Shalihin et al., 2019). According to Oner et al. (2016), outside classroom environment offer opportunities for promoting teaching and learning in addition to learning that takes place in the primary learning process.

Putting religion into STEAM is positively correlated with multiple adolescents and educational outcomes (McMorris, 2016; Shalihin et al., 2019). As shown in Figure 1, a symbol of the integration of the six elements, to create wholeness in the education system. This view is supported by McMorris study (2016) on the relationship between religious practice and academic engagement shows that higher levels of involvement are associated with positive academic dividends and improvements in overall schooling. Trensains represents this by organizing *Tahajud Fisika* (Physics at night prayers) program. This program aims to construct students' capability in intellectual and spiritual as a creature of God (Shalihin et al., 2019). Therefore, STREAM may provide and support the profile of graduates (Agustina et al., 2018).

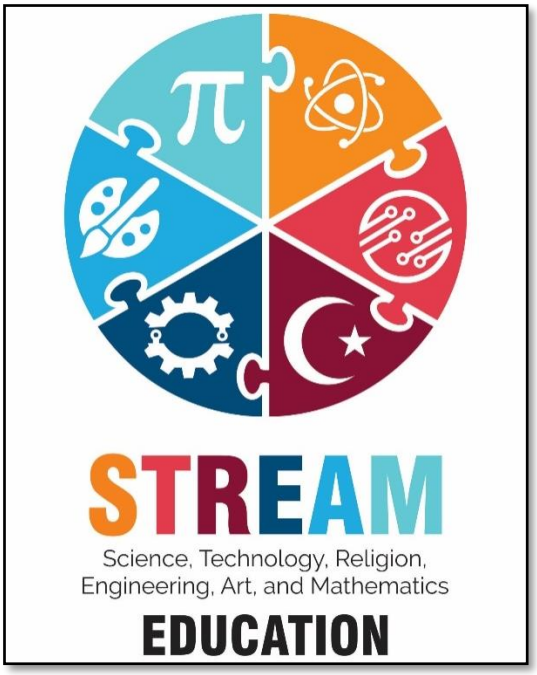

Figure 1. STREAM Education

A study brought by Billingsley et.al. (2014) found that even though science teachers in England confront a struggle to collaborate science and religion nevertheless religion has influenced their teaching approach of particular topics. Science helps students to answer "How" questions and technology, engineering, art, and mathematics had a role as a tool to bring the solution. Meanwhile, religion would answer "Why" questions, explaining something beyond science. Religion would give students richer epistemic insight to deal with problems (Billingsley et al., 2014; Billingsley et al., 2013).

CONCLUSION

In this editorial, the authors proposed the inclusion of R (Religion) in the STEAM approach. Therefore, it is highly recommended for inserting religion in the discussion of STEAM in the next future to become STREAM- Science, Technology, Religion, Engineering, and Mathematics.

REFERENCES

Abdul Razzak, N. (2020). Paulo Freire"s critical and dialogic pedagogy and its implications for the Bahraini educational context. *Educational Philosophy and Theory*, (Article in press). https://doi.org/10.1080/00131857.2020.1716731

Abidah, A., Hidaayatullaah, H. N., Simamora, R. M., Fehabutar, D., & Mutakinati, L. (2020). The Impact of Covid-19 to Indonesian Education and Its Relation to the Philosophy of "Merdeka Belajar". *Studies in Philosophy of Science and Education, 1*(1), 38-49. https://doi.org/10.46627/sipose.v1i1.9

Agustina, T. W., Rustaman, N. Y., Riandi, R., & Purwianingsih, W. (2018). Plant physiology with mathematic and art religion engineering science and technology approach. *Proceedings of the International Conference on Islamic Education, 261*, 43–47. https://doi.org/10.2991/icie-18.2018.8

Arikan, S., Erktin, E., & Pesen, M (2020). Development and validation of a STEM competencies assessment framework. *International Journal of Science and Mathematics Education*. https://doi.org/10.1007/s10763-020-10132-3

Billingsley, B., Riga, F., Taber, K. S., & Newdick, H. (2014). Secondary school teachers' perspectives on teaching about topics that bridge science and religion. *The Curriculum Journal, 25*(3), 372-395. https://doi.org/10.1080/09585176.2014.920264

Billingsley, B., Taber, K.S., Riga, F. et al. (2013). Erratum to: Secondary school students' epistemic insight into the relationships between science and religion—a preliminary enquiry. *Research Science Education, 43*, 1733. https://doi.org/10.1007/s11165-012-9325-y

Daugherty, M. K. (2013). The prospect of an "A" in STEM education. *Journal of STEM Education, 14*(2).

Good, J. J., Bourne, K. A., & Drake, R. G. (2020). The impact of classroom diversity philosophies on the STEM performance of undergraduate students of color. *Journal of Experimental Social Psychology, 91*, 104026. https://doi.org/10.1016/j.jesp.2020.104026

Guyotte, K. W., Sochacka, N. W., Costantino, T. E., Walther, J., & Kellam, N. N. (2014). STEAM as social practice: Cultivating creativity in transdisciplinary spaces. *Art Education, 67*(6), 12–19. https://doi.org/10.1080/00043125.2014.11519293

Honey, M., Pearson, G., & Schweingruber, H. (2014) STEM Integration in K-12 education: Status, prospects, and an agenda for research. *Committee on Integrated STEM Education; National Academy of Engineering; National Research Council.*

Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM Education, 3*(1). https://doi.org/10.1186/s40594-016-0046-z

Land, M. H. (2013). Full STEAM ahead: The benefits of integrating the arts into STEM. *Procedia Computer Science, 20,* 547–552. https://doi.org/10.1016/j.procs.2013.09.317

Liao, C. (2016). From interdisciplinary to transdisciplinary: An arts-integrated approach to STEAM education. *Art Education, 69*(6), 44–49. https://doi.org/10.1080/00043125.2016.1224873

Lou, S. J., Shih, R. C., Ray Diez, C., & Tseng, K. H. (2010). The impact of problem-based learning strategies on STEM knowledge integration and attitudes: An exploratory study among female Taiwanese senior high school students. *International Journal of Technology and Design Education, 21*(2), 195–215. https://doi.org/10.1007/s10798-010-9114-8

McMorris, J. E. (2016). *The role of religion and gender in shaping STEM education and workforce participation*. The University of Texas at Austin.

Morgan, D. L. (2014). Pragmatism as a paradigm for social research. *Qualitative Inquiry, 20*(8), 1045–1053.

Muslih, M. (2018). Pembelajaran ayat-ayat kawnīyah di SMA Trensains 2 Pesantren Tebuireng Jombang. *ISLAMICA: Jurnal Studi Keislaman, 12*(2), 455–480. https://doi.org/10.15642/islamica.2018.12.2.455-480

National Art Education Association. (2019, May 23). *NAEA Position Statement on STEAM Education.* https://www.arteducators.org/advocacy-policy/articles/552-naea-position-statement-on-steam-education

National Research Council. 2009. *Learning science in informal environments: People, places, and pursuits*. The National Academies Press. https://doi.org/10.17226/12190

Oner, A., Nite, S., Capraro, R., & Capraro, M. (2016). From STEM to STEAM: Students' Beliefs About the Use of Their Creativity. *STEAM, 2*(2), 1–14. https://doi.org/10.5642/steam.20160202.06

Padgett, A. G. (2005). God versus technology? Science, secularity, and the theology of technology. *Zygon®, 40*(3), 577–584. https://doi.org/10.1111/j.1467-9744.2005.00689.x

Padhmasari, T. (2016). *Pembelajaran PAI dalam kurikulum semesta: Studi kasus di SMA Trensains Tebuireng Jombang* [The Islamic education of universalism curriculum: Case study in Trensains Senior High School of Tebuireng Jombang]. [Master's Thesis, Maulana Malik Ibrahim State Islamic University]. http://etheses.uin-malang.ac.id/id/eprint/6229

Prabowo, M. (2007). Peran sekolah dan pendidikan kesenian sebagai pengembang ilmu pengetahuan, teknologi, moral, dan agama. *Majalah Ilmiah Pembelajaran, 2,* 1-9.

Riga F. (2020). Pragmatism John Dewey. In: Akpan B., Kennedy T.J. (eds) *science education in theory and practice.* Springer Texts in Education. Springer, Cham. https://doi.org/10.1007/978-3-030-43620-9_16

Rolling, J. H. (2016). Reinventing the STEAM engine for art+design education. *Art Education, 69*(4), 4–7. https://doi.org/10.1080/00043125.2016.1176848

Root-Bernstein, T. (2011, April 11). *The art of scientific and technological innovations*. ScienceBlogs. https://scienceblogs.com/art_of_science_learning/2011/04/11/the-art-of-scientific-and-tech-1

Shalihin, R. R., Bahriya, F., & Wantini, W. (2019). The implementation of qauniyah verses based on unification curriculum in SMA Trensains. *Jurnal Manajemen Pendidikan Islam, 4*(2), 70. https://doi.org/10.18860/jmpi.v4i2.8274

Suprapto, N., Ku, C.-H., Cheng, T.-H., & Prahani, B. K. (2020). Editorial: The Launch of Studies in Philosophy of Science and Education (SiPoSE). *Studies in Philosophy of Science and Education, 1*(1), 1-3. https://doi.org/10.46627/sipose.v1i1.3

Sutrisno, M. & Verhaak. (1993). *Estetika: Filsafat keindahan.* Kanisius

Suyono & Hariyanto. (2011). *Belajar dan pembelajaran: Teori dan konsep dasar.* Rosdakarya.

Swaminathan, S., & Schellenberg, E. G. (2015). *Arts education, academic achievement and cognitive ability.* In P. P. Tinio, & J. K. Smith (Eds.). The Cambridge handbook of the psychology of aesthetics and the arts (pp. 364–384). Cambridge University Press.

Taber K. S. (2020). *Mediated learning leading development the social development theory of lev Vygotsky.* In: Akpan B., Kennedy T.J. (eds) Science education in theory and practice. Springer Texts in Education. Springer, Cham. https://doi.org/10.1007/978-3-030-43620-9_19

TEAL Center staff. (2011). *TEAL center fact sheet no. 10: Self-regulated strategy development*. U.S. Department of Education, Office of Career, Technical, and Adult Education. https://lincs.ed.gov/state-resources/federal-initiatives/teal/guide/metacognitive

The White House. (2011, January 25). *Remarks by the President in State of Union Address.* https://obamawhitehouse.archives.gov/the-press-office/2011/01/25/remarks-president-state-union-address

White, D. W. (2014). What is STEM education and why is it important.? *Florida Association of Teacher Educators Journal, 1*(14), 1-9.

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