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Promoting STEM (Science, Technology, Engineering, and Mathematics) for Young Learners of Indonesia

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ABSTRACT

This paper describes youth as the next generation of Indonesia who must be understood and inspired for their subsequent learning and career STEM (Science, Technology, Engineering, and Mathematics) based. STEM discipline is commonly an inconvenient subject for youth, especially young learners. Collecting research papers that prove STEM had positively supported youth for their learning and career, this paper will recommend young learners become inspiring and produce a product in the future. Generally, it explores new trends overseas that Indonesia also has a chance for needed-promoted youth's skills for further education.

Keywords: Promoting, STEM, Young Learner.

I. Introduction

Science, mathematics, engineering, and technology (STEM) are cultural achievements that reflect people's humanity, power the economy, and constitute fundamental aspects of our lives as citizens, workers, consumers, and parents (Committee on Highly Successful Schools or Programs in K-12 STEM & Education; National Research Council, 2011). The United States is widely believed to perform poorly in STEM education (B.Gonzales & J.Kuenzi, 2012). Meta-analysis was employed to address the research questions of this study. Twenty-eight studies were selected, and thirty-three effect sizes were calculated to examine the effects of integrative approaches among STEM subjects. The impact of integrative approaches on the grade levels showed the most significant effect size at the elementary school level and the smallest effect size at the college level.

Regarding the types of integration, STEM, the integration of four subjects, presented the most prominent effect size. E-M and M-S-T showed the smallest effect size (*EBSCOhost | 72320466 | Effects of Integrative Approaches among Science, Technology, Engineering, and Mathematics (STEM) Subjects on Students' Learning: A Preliminary Meta-Analysis.*, n.d.). On the other hand, the Attitudes towards Science, Technology, Engineering, and Mathematics (AT-STEM) questionnaire was developed in the Indonesian language and validated through an exploratory factor analysis of participants' responses (Suprapto, 2016). The results indicated that, first, the instrument used in this study had satisfactory validity and reliability. The construct validities of the AT-STEM varied from .60 and .96 and explained 86.84% of the variance. Overall, the Cronbach's alpha coefficient of the instrument was .94. Second, the dimension of Mathematics came in the first rank and was followed by science and the degree of attitudes towards STEM. Last, the results also showed a significant interrelationship among dimensions of attitudes towards STEM (Suprapto, 2016). Based on the studies mentioned, STEM has become part of human development to improve their quality of life, especially education.

In Indonesia, the process of learning mathematics with STEM approach in Indonesia is aspects of preparation include prepare media and learning resources, prepare activity sheet, design tools and

materials of practice, parts of learning implementation are introduction has prepare students psychologically and physically before the learning process, asking questions about previous knowledge related to the material to be studied, using the STEM approach in the lesson, the content includes using the learning approach based inquiry, linking matter with daily life, practice, involving students in training, students actively engage practice in Classroom, guiding students in practice, utilizing technology (computers, internet), using active learning strategy, communicate actively to students during learning, giving tasks in groups, using problem solving learning method, combining STEM in one subject (at least 2 STEM disciplines), students are motivated to like mathematics, develop teaching materials, teach according to the field, there is no gap between learners (Milaturrahmah et al., 2017). Other studies another study was done to depict Project Based Learning (PjBL) integrated with science, technology, engineering, and mathematics (STEM), to enhance elementary school students' science literation (Afriana et al., 2016; Kholis & Aziz, 2019). In addition, creativity is an important capability that should be held to competitive standards in the 21st century in entering the era of information and knowledge. It requires a creative generation that can innovate to meet the challenges of an increasingly complex future. This study examines the student's creativity level by integrating STEM (Science, Technology, Engineering, and Mathematics) knowledge to make creative products in renewable energy (solar energy) (Mayasari et al., 2016). On the other hand, students most likely become users rather than producers of STEM's product development. By taking this reason, it is needed to make young learners aware of it.

Subject areas involving mathematics, science, engineering, and technology, and lists of jobs connected to each subject area (physicist, chemist, astronomer, biological scientist, mathematician, lab technician, analyst, veterinarian, etc.) need to be explored. This study also motivates K-12 schools, community colleges, and universities to implement new STEM and 21st-century skills programs. Students in Indonesia have performed below those of other countries (Suprapto, 2016). According to predictions, the STEM (Science, Technology, Engineering, and Mathematics) sectors will increase more than jobs in other sectors in the next decade. Therefore, the importance of STEM

education has been realized by academia, government, society, and industry (Bybee, 2010). The students possibly do not work based on their educational background in the future. The role of education as basic-career advancement has been aimed in the international setting (Mayo, 2009). Therefore, STEM education could be a way to bridge the gap between education and required workplace of 21st- century skills (Mutakinati et al., 2018). STEM-based instructional material developed is valid enough to be used as educational materials necessary for effective STEM education (Gustiani et al., 2017). The teachers quite well understand STEM education. We must focus on the teachers as they play a crucial role in the success of new reforms. The implication is that there is a considerable need for awareness-raising at both government and teacher levels to embrace STEM education (Nugroho et al., 2019). These trends presented that STEM could be included in the curriculum, by then how to make those learners visible to learn more than become their inspiration and further-career

II. Research Method

Research Design

This study applies the qualitative inquiry model. It interprets or explains the meaning of events, actions, and so forth; they generally use the following types of interpretation: construction of patterns through analysis and re-synthesis of constituent parts. This interpretation may lead to the generation of theories, be guided by existing approaches or concept maps, or seek to further explicate or expound upon an idea (Ary et al., 2010). Practically, this study explores the STEM advantages towards learnings and careers. Data collected such as experiences, beliefs, and values the researcher will be the modal of promoting STEM for young learners in Indonesia.

III. Result and Discussion

The result of this is going to be presented. The presented material to promote STEM is adopted from National STEM Learning Centre or accessible on (*Being Engaging and Inspiring in STEM - Inspiring Young People in STEM: Planning and Organising Practical Activities - National STEM Learning Centre*, n.d.). The first step is to engage and inspire young learners in STEM, such as Clyde's project in the Classroom. It is a project where kids are given fish eggs to rear in the school for about seven weeks. During that time, they learn about fish biology. They are very hands-on, looking after the

eggs. And then, at the end of the project, they release the eggs into their local bit of river (*Inspiring Young People in STEM: Planning Activities Being Engaging and Inspiring in STEM*, n.d.). As common sense, science, technology, engineering, and math are complex subjects for young learners; the students' scores may not be good enough for those subjects. Planning and organizing STEM to learning is homework if the facilities is completely support. Facilities support that teaching-learning process. Simply, today young learners were familiar within gadget such mobile phone and laptop. Accessible materials from teachers better get inside on learners' phone.

Three examples of activities are engaging and inspiring young people about STEM. They are Shopping Centre-Chemistry science busking, Classroom visit-Clyde in the Classroom, and Skype call to researchers in LIGO (Laser Interferometer Gravitational-Wave Observatory)(Examples of Activities - Inspiring Young People in STEM: Planning and Organising Practical Activities - National STEM Learning Centre, n.d.). Those three activities are promoting for young learners in voluntary activities.

If it applies to formal education, the next one to engage STEM to the curriculum; the link it with employability skills. There are four steps you need to identify an area of the curriculum that links to your work and volunteering activity (Engaging with the STEM Curriculum - Inspiring Young People in STEM: Planning and Organising Practical Activities - National STEM Learning Centre, n.d.). They are: firstly, find the relevant key stage and age in your country; secondly, find the national curriculum or similar (countries have different terminology) for that age; thirdly, find the subject heading, e.g., science, technology, design, etc.; fourthly, find the sentence/s relating to the syllabus and learning outcomes. In addition, to connect with employability skills is needed, such as knowledge, technical skills, and attitude. Those soft skills would help learners bargain themselves in the following professional level.

This is particularly important if you aim to complement curricula or other frameworks (Activity Objectives and Learning Outcomes - Inspiring Young People in STEM: Planning and Organising Practical Activities - National STEM Learning Centre, n.d.). At least, it must have activities objectives and learning outcomes set in the learning scenario.

On the other hand, it should also be

concerned about risk and hazards. An obvious starting point to the process of developing risk assessments is to understand what we mean by risk (Risks and Hazards - Inspiring Young People in STEM: Planning and Organising Practical Activities - National STEM Learning Centre, n.d.). The Institute of Risk Management defines it as 'the combination of the probability of an event and its consequences. These events and consequences can benefit (upside) or threaten success (downside). Our party popper can add to the sense of fun and celebration at an event. But, it might scare your dog!

On the other hand, The UK Health and Safety Executive defines a hazard as something with the potential to cause harm, including ill health and injury, to persons or to cause damage to property or equipment. A risk is the likelihood of a hazard causing harm in practice (Risks and Hazards - Inspiring Young People in STEM: Planning and Organising Practical Activities - National STEM Learning Centre, n.d.). Then, the risk assessment process is an essential part of risk management, and risk assessment can also be used as a valuable tool for activity planning.

After understanding all, the planning is the next. Practically, planning is deeply paying attention to the previous underlined terms. Planning also needs to be shared, so the paper airplane plans are better. It is applicable for teachers for learners are impressed with STEM inside materials they have been learning.

The final points are how young learners have the best career-related STEM after being inspired by STEM activities and volunteering. This study will note-getting better learners to find "figure" or introduce figures who succeeded in STEM. Come in for the Indonesian context; BJ Habibie represents that figure, and he had focused on airplane projects for better vehicles for Indonesia.

IV. Discussion

STEM is not a difficult and rich subject, but it is an enjoyable one. It needs teachers, examples, models, and a supporting system. Policymakers must also be provoked to up line and decide Indonesia's future by seeing globalization atmosphere. Young learners get better at practicing their understanding of STEM, limited to the theoretical framework and practical activities helped by teachers' airplane plans. In addition, it is becoming better to adopt other countries' STEM Success, such as UK and US. Young learners would like very helpful for having this; because it will provide new trends

vacancies for them in the future.

Last but not least, concerning Islamic education, STEM should be introduced earlier. Common perspectives realized that young learners who take education at Islamic education are not good enough in mastering STEM even though they work towards STEM. So, it is essential to comprehend earlier. Islamic education should add code-of-conduct of these terms to avoid misleading usage. Those four disciplines: Science, Technology, Engineering, and Mathematics, could be the difficult subject the first time students know it. After some semesters, they might be familiar with them; then they understand and comprehend these terms little by little, supported by teachers' creativity.

V. Conclusion

The final words to this paper are that Science, Technology, Engineering, and Mathematics (STEM) is not something new unless students had understood it earlier. It is not easy to comprehend, but educators and students can understand how to become good next time and level. On the other hand, STEM today is an 'indiscipline that tries to share slowly with young natives, starting from toddlers to young, simply from elementary to university.

The recommendation of this study is for further research applying action research that trains young learners practically about STEM-based learning for their future careers. In addition, this STEM could be integrated with teaching and learning strategies. Also, if STEM promotes Islamic-young-learners to Indonesia, it would give a real contribution to Indonesia and Islam.

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