

A Preliminary Study: The Urgency of STEM-Based Science Practicum Book for Secondary School

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ABSTRAK

Abstract: The research purpose is to analyse the needs of Science Technology Engineering and Mathematic (STEM)-based science practicum books for secondary school. This is descriptive qualitative research with questionnaire and interview methods. The sample of this research were secondary school science teacher and students. The data were analysed descriptively with the results of data processing in percent (%). The results showed that 98% of secondary school science teachers did not know that STEM-based practicum activities could train 21st century students' skills and 90% of secondary school students stated that they never carried out practicum activities other than laboratory activities. The results also shows that 75% of students do not have science practicum book and only have worksheets provided when carrying out practicum activities. Furthermore, the results of the study also showed that 70% of students stated that practicum activities were not discussed deeply when they entered the class. It can be concluded that there is an urgency to develop a STEM-based science practicum book to that can practice students' 21st century skills in facing the era of the industrial revolution 4.0.

Abstrak: Tujuan penelitian ini adalah untuk menganalisis kebutuhan buku praktikum IPA berbasis *Science Technology Engineering and Matematic* (STEM) untuk sekolah menengah. Jenis penelitian ini adalah deskriptif kualitatif dengan metode angket dan wawancara. Sampel penelitian ini adalah guru dan siswa IPA SMP. Data dianalisis secara deskriptif dengan hasil pengolahan data dalam persen (%). Hasil penelitian menunjukkan bahwa 98% guru IPA sekolah menengah tidak mengetahui bahwa kegiatan praktikum berbasis STEM dapat melatih keterampilan siswa abad 21 dan 90% siswa sekolah menengah menyatakan tidak pernah melakukan kegiatan praktikum selain kegiatan laboratorium. Hasil penelitian juga menunjukkan bahwa 75% mahasiswa tidak memiliki buku praktikum IPA dan hanya memiliki LKS yang disediakan saat melaksanakan kegiatan praktikum. Selanjutnya hasil penelitian juga menunjukkan bahwa 70% mahasiswa menyatakan bahwa kegiatan praktikum tidak dibahas secara mendalam ketika memasuki kelas. Dapat disimpulkan bahwa ada urgensi untuk mengembangkan buku praktikum sains berbasis STEM yang dapat melatih keterampilan abad 21 mahasiswa dalam menghadapi era revolusi industri 4.0.

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Information technology and communication has changed the way we learn, the way we are doing some works, and the meaning of social relation. Take a joint decision, sharing the information, collaboration, and innovation are very important aspect now days. success indicators are based on the ability to communicate, sharing, and using that information to solve a complex problem and expanding the power of technology to create a new knowledge.

All of the succses indicator can be train on a face to face larning method. One of the effective method is laboratoye experience or we call it a practicum. Practicum can help students to upgrade their skill and also help student to understanding more about science concept. Experience in the laboratory and exercising scientific skills are key factors in science education, to empower the future scientists with a skillset that fills the needs of the scientific community (Lynch & Ghergulescu, 2017). That's why the experience in the laboratory realy important, to train the students skill, especially if we combine the laboratory experience with STEM approach. Whats is STEM? NSF define STEM fields broadly, including not only the commong categories of mathematic, natural science engineering and computer and information sciences, but also such as behavioral/social sciences as shycologys, economics, and political sciences (Breiner et al., 2012). STEM can help students to train the 21st skill to face the revolution industry era 4.0. That's why the laboratory experience based STEM for secondary students is really important.

In Indonesia, STEAM is still a new approach that's really fit to be teach to the students from secondary school. Especially, when students doing an experimental laboratory. It really fits with the Indonesia new curricullum for secondary students. experimental laboratory actually not a new things for secondary school students, but experimental laboratory based on STEAM is totally a new thing for students and also a teacher of secondary school.

Observations carried out that teacher and students of secondary scholl did experimental laboratory only using a book from the govermants. The book is really good when we talk about the integrated science, but it don't really have a STEM approach on it. Interview with teachers also shows that teacher really exited to understand and tring STEM on their experimental laboratory activity. But they said that thet didn't have enough reference about STEM aspeciallly on laboratory experimental modul. Students also said that they were heard about STEM from youtube, but they don't really have an experiment on class or laboratory to help them to understaning more about STEM and the athmosphere of study based STEM. Teacher said that if they have a books that help them to guide the class based on STEM it will be very gratefull.

Some research about STEM already did, like the development of Thermodynamics KIT based STEM (Nursari & Okimustava, n.d.), and development of students worksheet based STEM on Works and Energy Topics (Puri, 2019). The result shows the feasibility and effectivity on a good range. But the research has a couple limits, like the KIT only used by the higher level education, with a very limited topic. As at the secondary school level, it is very suitable if direct learning is applied in the form of practicum activities with manuals based on STEM syntax, because it is in accordance with the expectations of the 2013 curriculum (Utami et al., 2018). Research about the STEM based practicum books for secondary school are very limited is a very sting reason for researcer to did this research, and one of the first step to complete the research is to know the urgency of STEM-Based science practicum books for secondary school students.

METHOD

This is descriptive research with qualitative approach. QD has been identified as important and appropriate for research questions focused on discovering the who, what, and where of events or experiences and on gaining insights from informants regarding a poorly understood phenomenon (Kim et al., 2017). Basic idea reason using this method is because this is preliminary research to know the urgency of STEM-based science practicum books, and researcher go to the field to collect the data by our team shelf, that's why this method is the one who most suitable. The goal of descriptive research is to describe a phenomenon and its characteristics (Nassaji, 2015).

This research starts with literature study to know the common issue on teaching and learning field. The next step of this research is prepare the instrument to collect the data, that the instrument should be valid and reliable. To determine whether an instrument has high quality, measurement properties such as reliability and validity need to be assessed (Scholtes et al., 2011). Instrument for this research is questionnaires. After making sure that the instrument is valid and reliable, the preliminary study started. The instrumen spread out to the sample. To determine whether an instrument has high quality, measurement properties such as reliability and validity need to be assessed. To determine whether an instrument has high quality, measurement properties such as reliability and validity need to be assessed. The sampling technique of this reseacrh is purposive sampling. The main pupose of this reseacrh is to know th urgency of STEM-Based practicum books for secondary school, so the sampling technique that goes well with the purposae is purposive sampling. So, the sample for this research are secpndary school teacher and students. The data that researcher get from the quisionnare was processed. The analysis method used was persentation descriptive analysis. The score process with persentation formula.

$$\% = n/N \times 100$$

RESULT

The result show that 90% students said that they didn't did any single practicum in a year, and only 10% students shows that they are doing practicum in a year. It absolutly not match with the statement that said practicum are important to do to help students understand the concept easily.

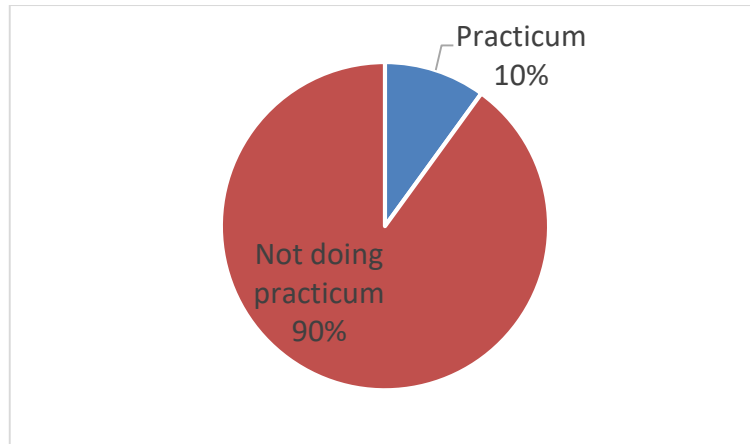


Figure 1. How often students did practicum in a year

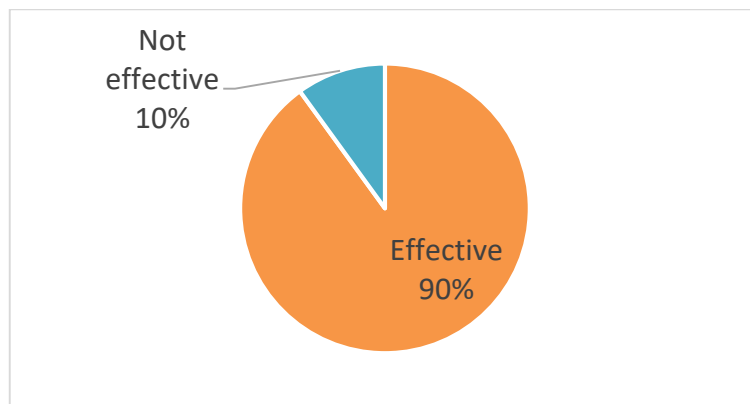


Figure 2. How many students feels practicum are effective to understanding the concept

As shown on Fig. 1, that only 10% students that in this year did a laboratory activity, and Fig. 2, shows that 90% students said that laboratory activity really helps them to understand the science concept and only 10% said that it not effective.

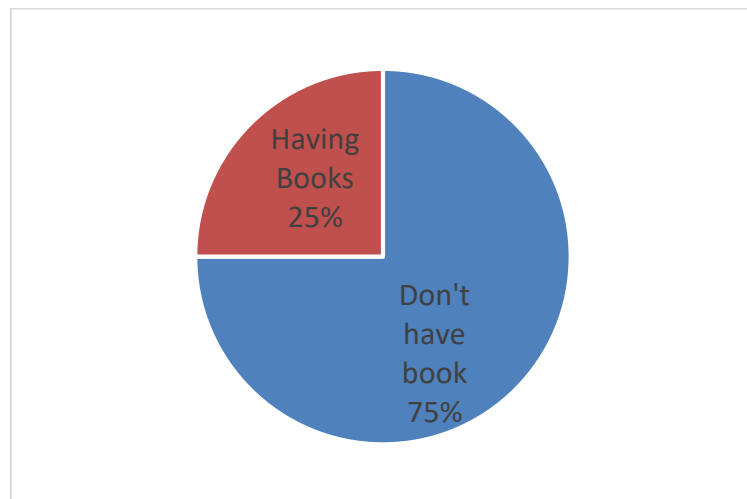


Figure 3. Students having a practicum book

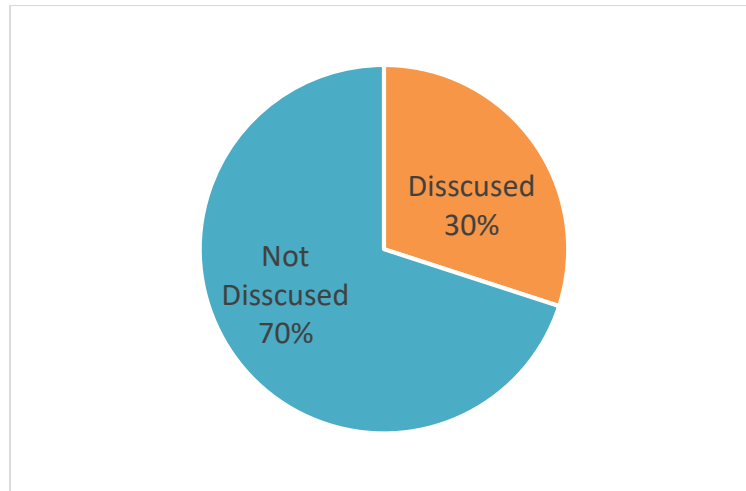


Figure 4. Students discussing Practicum Result in Classroom

According to Fig. 3, only 25% students who have a practicum books, beside a primary books that used at school, and 75% students said that they don't have any practicum books. As we know that practicum are really important to help students to understand the concept faster than study in a classroom.

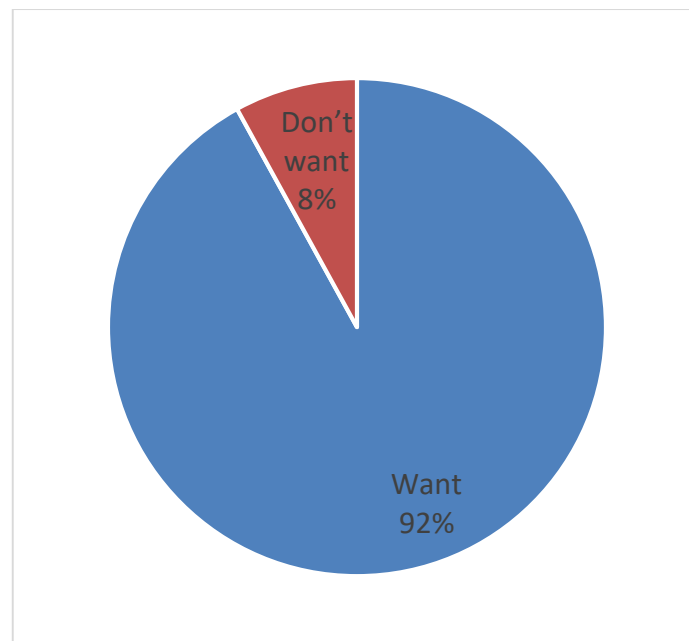


Figure 5. Students having a practicum book

As we can see from Figure 5 that 92% students want to have a practicum book to help them on laboratory experience. Doing a laboratory activity make a lot of advantages than learn the concept in the classroom. Laboratory activities, help students to hands on, mind on and train their collaboration skill. Laboratory activities also help students to train their scientific skills with curiosity. Especially if the laboratory experience based on STEM approach. STEM education perspective involves viewing the separate disciplines of science, technology, engineering, and mathematics as one unit, thus teaching the integrated disciplines as one cohesive entity. STEM professionals naturally practice integrated STEM and are less likely to compartmentalize disciplines as seen in the typical school subjects of chemistry, physics, math, or English (Zollman, 2012). That's the reason why STEM really need to add on our laboratory experience.

CONCLUSION

There is an urgency to develop a STEM-based science practicum book to that can practice students' 21st century skills in facing the era of the industrial revolution 4.0.

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