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Automatic water filling and capping machine trainer kit programmable logic controller controller prototype for vocational high school learning validity

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Automatic water filling and capping machine trainer kit programmable logic controller controller prototype for vocational high school learning validity

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Abstract. The purpose of this article is to find out validity level PLC controlled automatic water filling and capping machine as trainer kit for learning in industry automation competence expertise in vocational high school. Research type used in this research is research and development (R&D) according to Robert Maribe Branch. carried out steps are; Analyze, Design, Develop, Implement, and Evaluate. Instrument used is questionnaire and observation sheet. Collected data is analyzed descriptively. Research result shown that validation toward *automatic water filling and capping machine* prototype as trainer kit for PC practical learning in vocational high school which done by media expert, material expert, and student shown result in very satisfactory category, indicated by: (1) media experts give average score 87.5% (very satisfactory); (2) material experts give average score of 86,9% (very satisfactory); and (3) student give average score of 95,3% (Very Good)

1. Introduction

Science and technology today is rapidly developing. This science and technology advancement greatly affects the industry sector. Today industry is constantly developing and demanded to optimize operation skill quickly, cost-effective and innovative. Various industries today use high and sophisticated technology to create a product with superior quality to compete globally.

According to Ministry of Industry of Republic of Indonesia, on 2018 industry is the most significant sector that will greatly enhance Indonesia's and the world economic growth, this industry is divided into 5 sectors. These 5 sectors are basic iron, food and beverages, lifting tool machine, chemistry, and electronics.

Especially in industry that move in food and beverage sector, Central Bureau of Statistic (2017) records that food and beverage industry is capable to donate gross domestic product, non-gas fuel on quarter III/2017 summing 34,95% or highest in comparison with other sectors. Another sectors like metal, computer, electronic, optic and electrical tool industry contributes 10,46% and transportation equipment industry contributes 10,11%. In other hand, Ministry of industry also records that workforce contribution is dominated by food industry totaling 3.316.186 person or 21,34%.

To improve national food and beverage industry growth and structure, Ministry of Industry of Republic of Indonesia confirms that his party is supportive so this priority sector joins and support government program in education and industry vocational training. As an effort to fulfill the needs of workforce, Mministry of Industry asked food and beverages industry to develop collaboration with vocational high school in area near their factory to improve vocational high school competence.



Industry development must be supported by human work force that is reliable and competent. Vocational high school must produce graduate that competent and capable to compete according to industrial world need and demand that constantly developing. But today based on data obtained by central bureau of Indonesian labor, the sum of workforce in August 2017 is 128,06 billion is rising into 2,62 billion in comparison in August 2016. Component forming of the workforce is citizen that works and unemployed citizen. On August 2017, 121,02 billion working citizen and 7,04 billion unemployed. Seen from education level, open unemployment rate in vocational high school is the highest in comparison with similar level of education which is 11,41 percent. In other word, there is a supply of labor that is not absorbed especially in the vocational high school level. Cited from www.suaramerdeka.com (2017), Dirjen Dikdasmen states the high employment rate of vocational high school is due to inconsistency between available needs, number of graduation, and quality or competency of vocational high school graduate that is not absorbed in the working world.

In modern industry today more usage of industrial automation system is implemented to improve productivity. Through industry automation system, complex work can be handled and controlled by using machine that work automatically with accurate result, those machine utilize *Programmable Logic Controllers* (PLC) as controlling device. Through industry automation in vocational high school in competence of industry automation, student can learn science and technology on industry automation on the study program. But till this day there are obstacle and problem in the learning process especially in PLC learning so that graduate produced is still not met the competence that is needed by industry.

Researcher conducted a preliminary study to find out situation and condition on learning process conducted in industry automation expertise program in vocational high school especially on PLC practical learning. Preliminary study is done through observation in a vocational high school that has expertise program in industry automation. Observation is done in vocational high school 2 Depok, Sleman Yogyakarta Special Regency by interview with head of industry automation expertise program. According to the case study, it is found that learning process in PLC practical learning is done through programmable control system subject. In that subject learning media is very limited and still uses conventional learning media that not suited with today industry. Funding limitation is the source of problem why learning media is so limited. Drs. Bambang Irianto gives suggestion to researcher on learning media that will be developed which is, developed product is expected to be a learning media that is applicative and suited with today industry so student will be ready in industry in the future. Moreover learning media product that is applicative need to be supported with PLC practical learning module with mental revolution material, with the hope that student will have better mental.

According to the background the research is conducted and produces a PLC controlled prototype automatic water filling and capping machine trainer kit for learning in Industrial Automation Engineering Skills Competencies in Vocational High School. The purpose of this article is to find out validity level of PLC controlled automatic water filling and capping machine trainer kit for learning in Industrial Automation Engineering Skills Competencies in Vocational High School.

Hasan stated that a form of learning media is a trainer kit, that is a set of tools in lab that sed as learning media, which is a combination between work model or work process and object model or artificial object [1]. Artificial object is a simplified structure of main part in a process or system that complex. A set of tools in lab or workshop in the form of real object model or artificial object in industry as learning media equipped with tool guide is called industrial trainer kit. Industrial trainer kit is intended to support student learning process in applying knowledge or concept received on object or tools in industry. That opinion gives meaning that industrial trainer kit is a practice tool that used in learning in lab or workshop in the form of real object or artificial object in industry equipped with job sheet or practical learning module.

A form of another media is practical tool. This matter is strengthened by Rauner that practical is a tool or lab equipment [2]. Because of that it can be said that practical tool is the same as media in the concept of meaning, which is an information vehicle of learning information that channel learning information between information source with student as study information recipient, which covers

person, material, tool and activity that allow student to gain information, skill, and attitude. Another definition on practical tool is given by *Regional Education Center of Science and Mathematics*, states that practical tool is a tool or set of tools that used directly in practical learning or experiment in lab or workshop to develop skill, concept or knowledge for student [3]. According to definition above gave concept that the existence of practical tool in practical learning activities especially in vocational high school become very important, because student will use it in the practica which will give skill and needed concept mastery in working world.

Research that is relevant with this research is research done by Ranjit, on *solar educational trainer kit* development which yield result that *solar educational trainer kit* is capable to give the user an easy understanding on electricity energy charging, and conversion of DC electricity into AC electricity [4]. Another research is done by Aras and Azis on Remotely Operated Vehicle (ROV) trainer kit for education purposes, which shown result that ROV trainer kit is capable of giving an easy understanding on underwater vehicle control system that can be operated from afar [5]. Research conducted by Hong that investigating on development of educational robotic training kit, shown that the usage of educational robotic training kit in learning can greatly reduce cost, student easy to understand, and simple [6]. Other research done by Guo and Chen is on “Explore of Teaching Practice on Programmable Logic Controller”, it is shows that demonstration and experiment method by using PLC Siemens S7-200 in effective learning can improve student study interest, active class atmosphere, enhance teaching interaction, and increasing whole effect of the learning process in class [7]. All of the 4 mentioned researches above are different with this research, which is the function of the working object that developed on all 4 researches is different with this research development.

2. Method

Research type used in this research is research and development (R&D) which refers to ADDIE [8]. Steps taken in this research are: Analyze, Design, Develop, Implement, and Evaluate. Technique and instrument in in collecting data needed in this research are; (1) in study of need, data is collected through questionnaire instrument; (2) in evaluation activity on analysis of need, and design result, collecting data technique used is observation, while instrument used is observation sheet; and (3) in material expert, media expert, and student validation on developed product collecting data technique used is observation, while instrument used is observation sheet. In this research, instrument validity is determined by face validity, content validity, through expert judgement, to determine the reliability of instrument especially material expert, media expert, and teacher observation sheet, used Scot reliability. Data collected through this research is analyzed descriptively.

3. Result and Discussions

After research steps and development by using ADDIE according to Robert Maribe Branch, yield result the automatic water filling and capping machine prototype trainer kit of PLC practical learning in vocational high school. As for automatic water filling and capping machine prototype trainer kit prototype in PLC practical learning in vocational high school is shown in Figure 1.



Figure 1. Automatic water filling and capping machine trainer kit prototype as PLC practical learning trainer kit for vocational high school.

To figure out the validity level of the product, the automatic water filling and capping machine prototype trainer kit for PLC learning in vocational high school, the product is validated by 2 material expert, 2 media expert, and 4 vocational high school student. Validation is done by 2 expert in media field result is briefly presented in Figure 2.

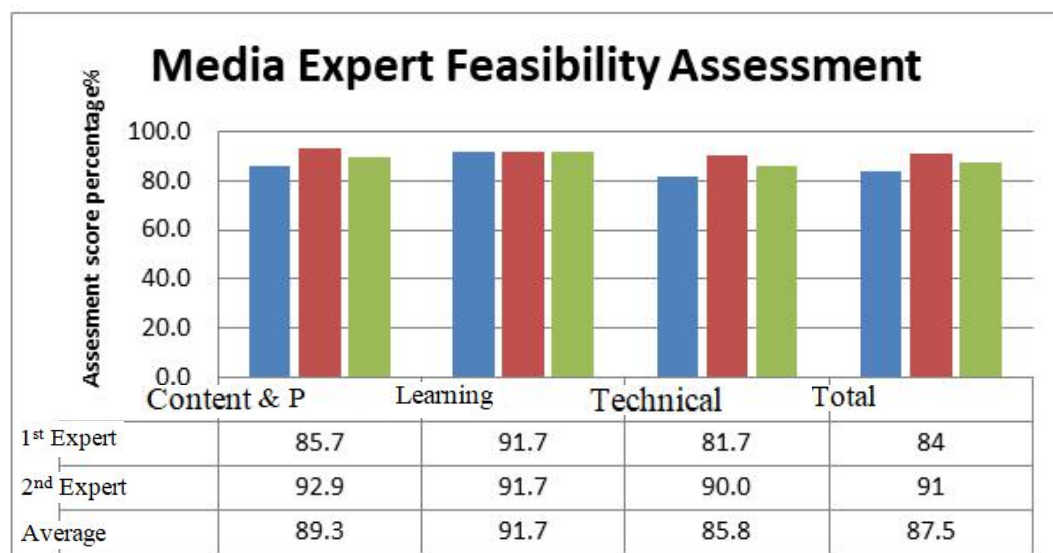


Figure 2. Feasibility Assessment Chart of Product Media Experts

Figure 2 shows that both experts give score with average percentage in content and purpose as much as 89.3% so it is considered in “very decent” category, learning aspect as much as 91,7%, so it is

considered in “very decent” category an in technical aspect 85.8% so it is considered in “very decent” category also. Based on data collected Automatic Water Filling and Capping Machine is considered “very decent” in terms of media as a PLC learning media to be used in Programmed system control in vocational high school with Industrial Automation Engineering Skill expertise competency. Validation done by 2 material experts on the product is briefly presented in Figure 3.

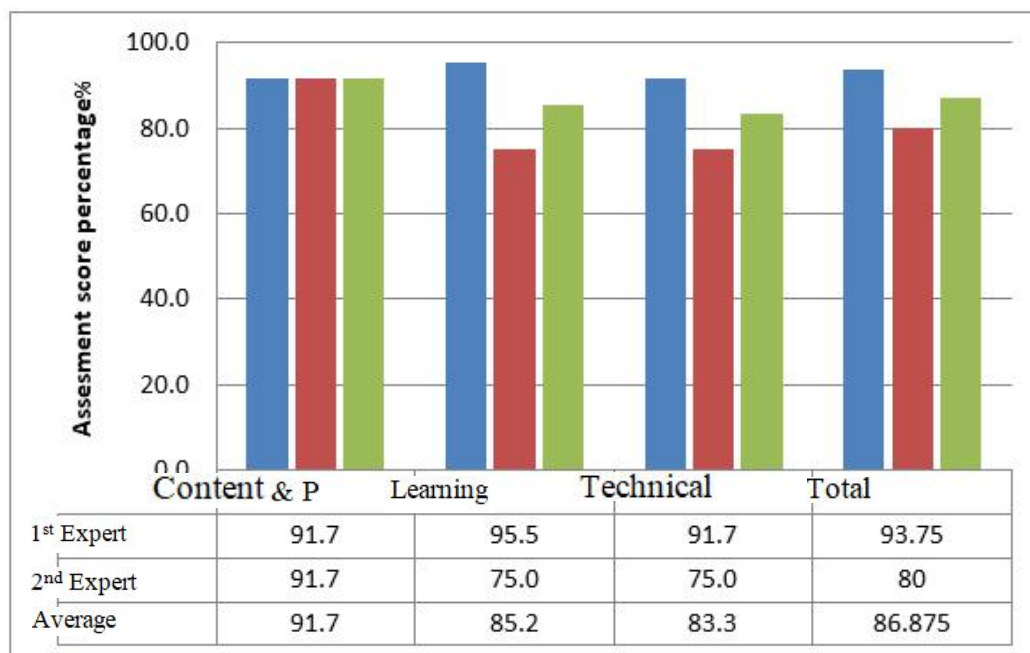


Figure 3. Material Expert Feasibility Assessment Chart

According to Figure 3 it is shown that both material expert gives score with average percentage in content and purpose as much as 91,7% so the product is considered in “very decent” category, learning aspect as much as 85.2%, so it is considered “very decent” and technical aspect 83.3% so it is considered in “very decent” category. Feasibility result of material by material expert is obtained by average percentage of every aspect summing 86,9% so it is considered “very decent”, based on the collected data, Automatic Water Filling and Capping is considered “very decent” in terms of material as PLC learning media to be used in Programmed control system subject in vocational high school with Competency in Industrial Automation Engineering.

Furthermore, the student also requested to give their opinion as vocational high school student as user candidate. Assessment result through vocational high school student on automatic water filling and capping machine product prototype as trainer kit for PLC practical learning in vocational high school is briefly shown in Figure 4.

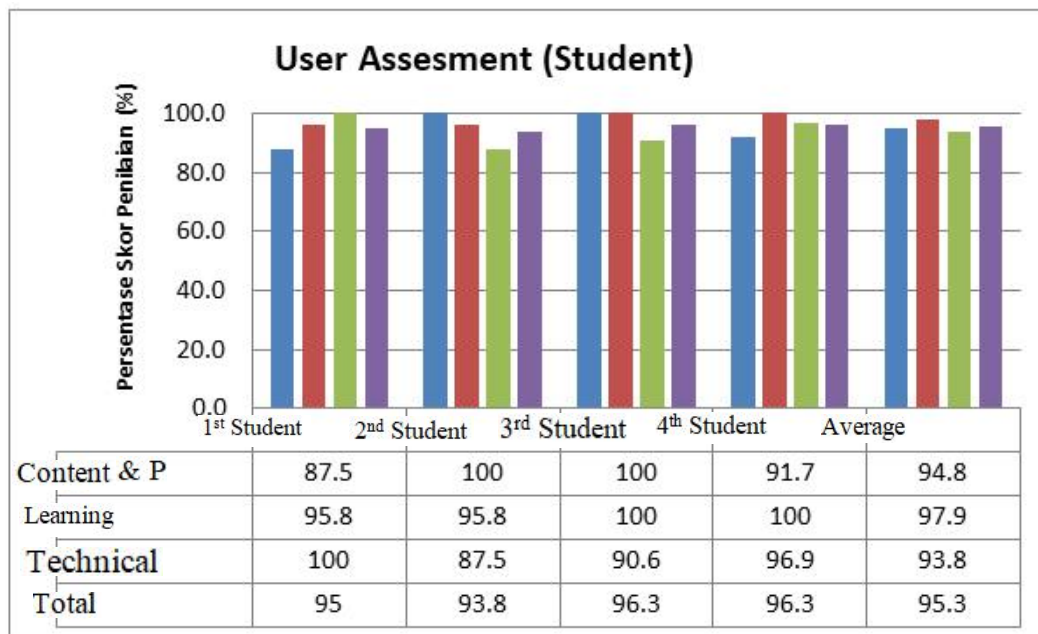


Figure 4. Students Assessment graphic.

Based on Figure 4 it is shown that all 4 students give scores with average percentages in content and purpose aspects as high as 94.8%, so it is considered in the “very decent” category. Learning aspects as high as 97.9%, so it is considered in the “very decent” category, and technical aspects as high as 93.8%, so it is considered in the “very decent” category. Through user test results, it is found that the average percentage of every aspect in the product assessment score is 95.3%. So it is considered in the “very decent” category. Based on collected data, the Automatic Water Filling and Capping Machine prototype is considered “very decent” as PLC learning media in a programmed control system subject in vocational high school in Competency in Industrial Automation Engineering expertise.

4. Conclusion

Validation on Automatic Water Filling and Capping Machine prototype as a trainer kit for PLC practical learning in vocational high school is done by media expert, material expert, and student, shown satisfactory results. This is indicated by: (1) validation by media expert on this product scored 85.75% on average, which means it is considered in the “very decent” category; (2) validation by material expert on this product scored 86.9% on average, which means this product is considered “very decent”; and (3) assessment by student on product scored 95.3 in overall aspect, so it is considered in the “very decent” category.

5. References

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