Medical Instrument Skill Competency in Vocational High Schools Based on Legal Rules in Indonesia

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Abstract. The application of electronic instrument technology to the health sector requires more detailed quality assurance and is guaranteed in the use, maintenance, repair and/or development of medical instrument devices. Improving the quality and quantity of medical instrument needs to be supported by an increase medical instrument personnel. This research was conducted to examine more about Indonesian medical/electromedical instrument personnel, specifically at vocational high school level in 2020 in an effort to overcome the challenges of the development of instrumental technology in the health sector. The lack of medical instrument personnel must be completed immediately without leaving its quality. Currently, there are regulations regarding the implementation of medical instrument education at the vocational high schools level, but vocational high schools are still constrained by regulations regarding the minimum qualifications for medical instrument education in the applicable regulations. This condition causes vocational high schools to date to have not implemented competency in medical device expertise even though it has been mapped on the spectrum of ministries. In fact, regulations serve as guarantees of operation quality, guarantee of competency criteria, guarantee of work quality, and guarantees for medical instrument personnel.

1. Introduction

During the last quarter of this century, there has been a tremendous increase in the use of electricity and electronic equipment in the medical field for clinical and research purposes. The application of electronic instrument technology to the health sector requires more detailed quality assurance. Guarantees refer to the use, maintenance, repair and/or development of medical instrument devices. The use of instrument devices in health services requires competent personnel. The medical instrument system's main function is to ascertain or determine the presence of several physical quantities that may be useful for diagnostic purposes. Therefore, many types of instrument systems are used in hospitals and doctors' clinics [1].

The increase in the use of medical instrument technology has not been followed by an increase in the number of institutions that have graduated medical instrument personnel. The fact is that the number and ability of electromedical personnel to deal with these problems are very lacking. Quoted from http://stikeswh.ac.id, on average, each year, there are around 600 graduates. Data from IKATEMI (Indonesian Electromedical Engineering Association) in 2014 required around 12,436 electromedical personnel to make electromedical power. They were much needed in hospitals, clinics, health centers and medical companies. Meanwhile, Dean of the Faculty of Electronics University of Patria Artha, Andi Nur Putri said that the need for electromedical energy had reached 8,000 people per year and had been...
sure to continue to increase. Following up the development of technology and the need for medical instrument personnel as well as the spectrum of vocational secondary education expertise that need to be harmonized, the Indonesian Education and Culture Ministry issued a Decree number: 4678/D/KEP/MK/2016 concerning on vocational secondary education expertise spectrum. In the decree, the spectrum of medical instrument expertise joins the electronic engineering expertise program [2].

The results of the discussion with one of the IKATEMI administrators and follow-up actions on the conditions were described. The author intended to study more about Indonesian medical/electromedical instrument personnel specifically at the vocational high school level in 2020.

2. Theoretical Review

2.1. Vocational High School (VHS)

Vocational High School (VHS) is a secondary level educational institution. Vocational high schools prioritize on developing the ability of students to do certain jobs in work and to develop professional skills [3]. According to Adhikary [4], vocational high schools are institutions designed to develop skills, understanding, insights, and competencies that are in accordance with the market demands. [5] said that the main purpose of the Technical and Vocational Education Training is to prepare workers in an effort to meet the labor market needs of the labor market in the country. In addition, vocational education must be responsive and adaptive to technological progress because it builds the role and mastery of science and technology [6].

2.2. Medical Instrument Education

Medical instrument is the application of scientific measurement to measure physiological variables that may occur due to molecular, cellular, or mechanical processes. These physiological variables can be improved in the form of mechanics, electricity, chemistry, optics, or other events [7]. In medical instrument systems, the main function is to measure or to determine the presence of several physical quantities that may be useful for diagnostic purposes. Therefore, many types of instrument systems are used in hospitals and doctors' clinics [1]. In general, medical instrument personnel are responsible for the support of technology used in health care. This support ensures the best use of safety equipment and patient care. Medical instrument workers work closely with medical staff to ensure that technology is used safely and effectively [8].

The development and change in the world of education in Indonesia is inseparable from the influence of global change, the development of science and technology, art and culture. The Directorate of Pengembangan Sekolah Menengah Kejuruan (PSMK) is a part of the Primary and Secondary Education Ministry. PSMK Directorate has a vision to educate the character and ecosystem of vocational high schools by working together in a mutually beneficial manner. PSMK has a mission 1) to build strong vocational high school, 2) to build broad, fair and fair access to vocational high school 3) to build a learning model in vocational high school, and 4) to obey government regulations, bureaucratic changes and public relations [9].

Current vocational high school competencies need to be balanced with development, curriculum, technology, and workforce needs. Following up on the development of medical instrument technology and increasing the number of uses of medical instrument devices, it is considered necessary to develop a curriculum. The curriculum is a key element in the scope of education that is very strong and motivating everyone involving in learning [10]. The Association for the Advancement of Medical Instrument (AAMI) [11] refers to medical instrument as a biomedical engineering/ equipment technician/ technologist (BMET). AAMI has stated that BMET I has a summary of work under the relatively strict supervision, repair, calibration, and maintenance of all types of equipment technology, devices, instruments, and basic clinical equipment systems as well as examination, installation and provision of preventative care for general clinical equipment. BMET I works under the strict supervision of BMET II/BMET Senior or clinical engineering supervisor. Considering the work of BMET I, VHS graduates will later fill the BMET I position.
There is huge needs for coordination with stakeholders in the group to access the shared knowledge base [12]. Furthermore, coordination and consultation with relevant stakeholders to discuss together about core competencies, and developing basic competencies will later be beneficial for the curriculum. The curriculum contains rules about system, implementation, and various educational standards that are in accordance to the results of coordination and consultation. The Directorate General of Primary and Secondary Education, Ministry of Education and Culture issued Decree No. 4678/D/KEP/MK/2016 concerning the Spectrum of Vocational Secondary Education Competencies. The Decree shows the spectrum of medical instrument competency expertise under the electronics engineering expertise program.

Following up on Decree No.4678/D/KEP/MK/2016 concerning the Spectrum of Vocational Education Competencies, the Ministry of Education and Culture considers core competencies and basic competencies to be adapted to the demands of developing science, technology, and work needs. The Director General of the Ministry of Education and Culture issues Decree No.330/D.D5/KEP/KR/2017 are concerned about core competencies and basic competencies for national content subject as : (A), territorial content (B), basic field of expertise (C1), basis program expertise (C2), and expertise competency (C 3) [13].

2.3. Electronic Engineering Education Program at UNY

Electronic Engineering Education is one of the educational study programs at the Faculty of Engineering, Universitas Negeri Yogyakarta (UNY) previously famous for IKIP. Based on Presidential Decree No. 93 of 1999 concerning the Amendment of IKIP to become a university [14]. From 1979 to 1988, UNY Electronic Engineering Education Study Program implemented government policies to implement a curriculum designed by the World Bank IV Project. This curriculum was designed to meet the needs of vocational high school teachers. UNY Electronics Engineering Education has been established since 1979 until now it is still consistent in producing electronic engineering education personnel. Electronics Engineering Education UNY currently has the high accreditation for Electronics Engineering Education study programs at bachelor level in Indonesia.

Table 1. Electronic Engineering Education Study Program, Undergraduate School in Indonesia.

| No. | University                        | Accreditation |
|-----|-----------------------------------|---------------|
| 1   | Jakarta State University          | B             |
| 2   | Makassar State University         | A             |
| 3   | Padang State University           | B             |
| 4   | Yogyakarta State University      | A             |

Source: [https://banpt.or.id/][15]

The 2017 UNY electronic engineering education curriculum is a development of 2014 version proof that the implementation of medical instrument has been prepared for a long time. Following up on Decision Number 4678/D/KEP/MK/2016 from the Directorate General of Primary and Secondary Education, it has been explained that medical instrument skill competency is included in the electronics engineering expertise program and is in line with the 2014 curriculum. UNY Electronics Engineering Education Study Program in 2016 began organizing medical instrument and electronics courses. This instrument and medical instrument course is to maintain the consistency of UNY Electronics Engineering Education study program in producing teaching staff in vocational education institutions.

2.4. Indonesian Electromedical Association

The Indonesian Electromedical Association (IKATEMI) is a health professional organization. IKATEMI is a forum to gather Indonesian professional technicians who are dedicated to the field of medical instrument. IKATEMI was created as a result of the quality of professionalism of Indonesian medical instrument services. IKATEMI is an effort to improve the quality of service and competency of medical equipment technicians, as well as to improve and to develop education for medical equipment...
technicians in Indonesia. IKATEMI serves as a forum for electromedical meetings. IKATEMI has the authority to establish partnerships with various parties to achieve goals. IKATEMI acts as a professional organization to promote the science and technology of the electromedical field to create a just and prosperous society blessed by God Almighty. IKATEMI was established with the aim of, among others: (1) Providing electromedical services and technology to improve public health and welfare of members. (2) Developing electromedical technology to improve public health and welfare of members. (3) Increasing professionalism to meet the requirements of quality, safety and excellence of electromedical tools in protecting the public and improving the welfare of members. (4) Integrating all electromedical potential of Indonesia, improving the dignity of electromedical profession, developing electromedical science and technology, and improving the health status of the Indonesian people towards a healthy and prosperous society. (5) Upholding organizational order, administration, regulation and efforts to improve professional competence and ethics supported by the establishment of effective communication systems and positive partnerships.

To achieve these objectives, the main tasks of IKATEMI are: (1) Carrying out re-registration of membership in an optimal, comprehensive and universal manner. (2) Encouraging IKATEMI members professionally. (3) Conducting research and development of electromedical technology. (4) Encouraging and developing cooperation with domestic and other countries' electromedical professional associations, both bilaterally and multilaterally. (5) Fostering and developing cooperation with legislative institutions, governments, universities, research institutions, industry, and the business world regarding matters needed for the development of science and technology and the development of the profession of electromedical engineering. (6) Increasing prosperity and channel aspirations, also protecting the interests of members so that their professional rights and obligations can meet. (7) Organizing an electromedical engineering certification system so that members can be recognized and given based on their professional abilities. (8) Organizing an advocacy system in electromedical engineering.

From the results of discussions with Agus Susilo Wibowo, ST (Chair of the Yogyakarta Regional Representative Council of IKATEMI) on July 26th, 2018, Agus gave his responses to various regulations and decisions issued by several stakeholders in Indonesia adhering to the Law of the Republic of Indonesia No. 36 of 2014. This law requires health workers to have at least Diploma Three graduates to maintain the quality of medical instrument person, reinforced by the Republic of Indonesia from the regulation of the Minister of Health of the Republic of Indonesia number 45 of 2015 concerning permits and implementation of electromedical practices [16]. Agus said that the Electronic Engineering Education Faculty of Engineering, YSU, is authorized to hold electromedical lectures as an introduction to basic electronic technology in the medical field. Meanwhile, as a preparation for vocational teachers in the competency of medical instrumentation / medical electronics expertise, IKATEMI has not been able to promise that there will be regulations allowing health workers to graduate from Vocational High School.

3. Similar Research
Aspiration Journal Vol. 5 No. 1, June 2014 was chosen because of the similarity of medical instrument technicians with nurses. Several years ago, nurses did not have clear rules regarding the formation and implementation of Education. At Efforts to produce quality nurses journal [17] concluded that due to the absence of clear rules regarding the formation and implementation of nursing education and the lack of involvement of the nursing professional organization by the government, nursing education system in Indonesia did not fully answer the needs of professionals and the nation.

The Development of Nursing Education in Indonesia is growing rapidly in quantity. This can be seen from the number of nurse education institutions. But in quality, nurses' recognition as a profession has not been optimized by stakeholders. The number of nurses who devote themselves as health workers has not been used optimally by the government. If this happens in the long run, it will be difficult to achieve its national goals that is to realize public health at the highest level.
4. Discussion

Law of the Republic of Indonesia No. 36 of 2014 concerning health workers. Article number 8 states that health workers consist of health workers and health assistant health workers are at least Diploma 3 graduates [18]. Regulated in paragraph 9 about health workers, it must be at least Diploma Three graduates except for medical staff. In article number 10, medical staff assistants must at least have secondary school graduates in the health sector. Regulations concerning the implementation of work for health assistants are then submitted in the Regulation of the Minister of Health of the Republic of Indonesia Number 80 of 2016 concerning the Implementation of Occupations for Assistant Health Workers [17]. More about electromedical technicians explained in Law No. 36 of 2014 market 11 paragraph 12. In paragraph number 12, electromedical personnel are included in the biomedical engineering staff who are a part of health workers as explained in the article, 1st paragraph. It can be concluded that labor electromedical at least Diploma Three graduates.

Considering the demands of the development of the curriculum, science, technology, and world needs of work, General Directorate of Primary and Secondary Education of the Ministry of Education and Culture readjusted the spectrum of vocational skills competencies. The Directorate General of Primary and Secondary Education of the Ministry of Education and Culture has issued Decree No. 4678/D/KEP/MK/2016 concerning the Expertise Spectrum of Vocational Secondary Education [2]. The Decree shows the addition of a spectrum of medical instrument expertise competencies under the electronics expertise program. It was followed by decision No. 330/D.D5/KEP/KR/2017 that deal with core competencies and basic competencies in the following national content subjects (A), territorial content (B), basic expertise areas (C1), basic skills programs (C2), and expertise competencies (C3). On its appendix, the details were presented regarding the details of core competencies and basic competencies in each aspect of the subject matter [13].

Following up on the Decree of the Director General of Primary and Secondary Education at the Ministry of Education and Culture No. 4678/D/KEP/MK/2016 which explains the addition of medical instrument expertise competencies, UNY Electronics Engineering Education Program as UNY Electronic Teacher Training Institute in 2016 began organizing a course on Medical Instrument and Electronics (known as IEM). It is expected that the implementation of IEM courses can maintain the consistency of the UNY Electronics Engineering Education Program in producing educational personnel in vocational education institutions that are in line with technological developments and the demands of the workforce.

Continuing in 2017, the Directorate General of Primary and Secondary Education of the Ministry of Education and Culture issued Decree No. 330/D.D5/KEP/KR/2017 concerning core competencies and basic competencies. With this decree, the implementation of lectures is more focused on the implementation of the second year (2017/2018). In the implementation of the 2nd year, Electronics Engineering Education of UNY was better able to adjust the competencies that were in accordance with the standards. Currently based on the main VHS data, which can be accessed online at http://datapokok.ditpsmk.net, there have been no vocational high schools that has built medical instrument expertise programs. Vocational high schools certainly do not dare to apply this education because the applicable law does not allow graduates to work directly.

5. Conclusion

Education system of medical instrument in Indonesia has not answered the profession's needs. At present, there are regulations regarding the implementation of medical instrument education at the VHS level. However, Vocational high schools still do not hold medical instrument education. Vocational high schools are still constrained by regulations regarding the minimum qualifications for medical instrument education in the applicable regulations. This situation has made VHS not have medical instrument skill competencies.

Regulation is a guarantee of the quality of implementation, guarantee of competency criteria, guarantee of work quality, and guarantee of medical instrument personnel that all are important. At present, the condition of medical instrument staff at the vocational high school level is still in transition.
Currently, the rules for implementing medical instrument at the vocational level have already existed, but the prevailing regulations in Indonesia did not allow VHS graduates to practice.

It is expected that in the future, the implementation of education in medical instrument expertise will be supported by government regulations that guarantee the quality of performance and workforce. The competencies taught in the implementation of education should be in line with the demands of developing science, technology and labor requirements. The quality of teaching staff should be standardized with appropriate certification.

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