

Indonesian Vocational Education Workplace Development

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Abstract. *Indonesia is now facing Industrial Revolution 4.0. It demands vocational education to be more adaptable in responding the changing model of learning which uses digital equipment in the classroom. Classrooms need to be equipped with supporting facilities such as computers as a control center for all learning resources in the classroom (Interactive Instruction Center, Resource & Class Management Server, Interactive Classroom Server), interconnected multimedia equipment and a strong internet network. Moreover, class characteristics that support the learning of the Industrial Revolution Era 4.0 accommodate the improvement of 4C's skills, i.e. critical thinking, creativity, communication, and collaboration. Therefore, the classroom layout, furniture and room size is easily changed, class is easy to be transformed into spaces with functions different (discussion room, consultation room, independent study, research, etc.). The integration of computer equipment, internet and multimedia in the classroom is needed to realize the learning system in the Indonesian Revolution 4.0 era. Each class room must have an HVAC (heating, ventilation, and air conditioning) system that is able to provide students with a comfortable learning process. Classrooms must be equipped with low-level electrical plugs spread evenly across the walls of the room, smooth and flat floors to facilitate furniture rearrangement, lighting that can be adjusted for group discussions, presentations, and video recording.*

Keywords: *Workplace, facilities, classroom.*

I. Introduction

Industrial revolution is commonly recognized as the swift and radical changes as a response to the human development in creating working equipment to improve industrial products. In 2020, Indonesia is entering the Industrial Revolution 4.0 era in which technology is integrated. It lessens the physical, digital, and biological border. This era affects almost all aspects in social even education fields as well as digital economy. The demands of the computerized will change the flow of education and the teaching landscape progress into new types of computerized teaching methods and smart classrooms [1]. The success of vocational education is influenced by the quality of human resources, market demands, and the ability to use technology [2]. Human resource development is as important as intelligent devices and systems to convert industry 4.0 [3]. Irianto in Ghuftron, et.al [4] mentioned three main purposes of 4.0 industry, i.e. shorten marketing time, improve flexibility, and encourage efficiency.

Technology has influenced human daily activities, therefore schools should be more adaptable and relevant to face the future and nowadays challenges. The collaboration between hard skills and soft skill skills is needed by the students to follow these changes. Thus, the students are required to have a willingness to Lifelong learning [5][6]. This era introduces innovations in improving education and skills to make future learning more

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specialized, super, smarter, portable, global, and virtual [7]. One of the efforts is designing a learning classroom which can accommodate 4.0 learning. It focuses on the development of critical thinking, creativity, collaboration, and communication skills [8]. Critical thinking is anything related to the problem solving. Creativity teaches students to think outside the box. Collaboration shows students how to work together in achieving common goals by communicating their ideas. The approach is commonly known as 4C approach namely: (a) becoming aware and literate in Web 2.0 tools; (b) giving assignments in the real world for students to solve using technology; and (c) creating collaborative learning experiences that utilize resources available through the Web [9].

Condition of vocational education requires an immediate change in curriculum and development of knowledge towards technological progress [10]. Education is also required facilities that support practical activities [11]. Appropriate learning methods are needed to reduce competency gaps [12]. Teachers need to get used to IT-based learning [13] to develop communication skills, creativity skills, critical thinking, and collaboration. These problems are successful to be solved. Hence, they have better understanding and skills [14]. In view of the problems appeared and the demands of the 4.0 era, there is a need for the availability of classes that support 21st century learning [21].

The availability of a classroom will bring advantages, i.e. (1) to support the availability of conducive learning spaces, industrial classes, teaching factories, and increasing teacher and student competencies; (2) to improve vocational graduates with the suitable competency; (3) to modernize the development of science and technology; (4) to fulfil curriculum demands; (5) to fulfil the demands of the work worlds which increasingly require competent workforce in accordance with the development of science and technology; (6) to fulfil the demands for facilities that are appropriate to the needs and development of technology.

The aims of the study describes the actual condition of vocational education classroom in Indonesia and propose a design of an ideal classroom to fulfill the need of industrial revolution 4.0 learning.

II. Methods

This research used research and development methods adopted by Borg & Gall (1983) in three main stages, such as pre-research, layout development, and model evaluation. Pre-research has conducted by studies and in-depth observations of nine vocational schools [15]. Observations were conducted on several selected schools including: Raden Umar Said Kudus Vocational School, Tunas Harapan Pati Vocational School, 1ND vocational school, Kartika Balikpapan Vocational School V-1, Surabaya Vocational School 3, Muhammadiyah Malang Vocational School 1, Vocational School 4 Malang, Wikrama Bogor Vocational School, Palangkaraya Vocational School 1, Palangkaraya Vocational School 3, Mikael Surakarta Vocational School. Fulfil data showed that there were still unprepared schools leading from building standards to meet the Industrial Revolution era 4.0. The results of the interview provided information that according to the Vocational School chosen to welcome the Industrial Revolution 4.0 era, what was needed was that all building standards be changed to a digital system, the expansion of *wifi* areas, the use of CCTV for security and online presence systems, as well as a building that was comfortable for learning and environmentally friendly. It can be seen on the Figure 1.

Classroom readiness data were generated from respondents' assessments to welcome the Industrial Revolution era 4.0 related to the availability of a centralized computer network, controlled / secure internet connection, equipped with computers as Interactive Instruction Centers, having Resource & Class Management Servers, and Interactive Classroom Server. These facilities are needed to support 21st century learning in realizing comfortable and attractive classes such as furniture and room sizes easily changed, easy to be transformed into spaces with different functions. Lighting, windows, color, accessibility, and proper line of sight, comfortable classroom atmosphere was influenced by well-organized class size, free movement, quiet, temperature control, and clean class since clean involves the interaction between students and its place condition [23]. Class with a specific program (moving class) equipped with multimedia projector can be connected with other media such as interactive whiteboard, a multimedia projector, and

display material in the form of audio video integrated with multimedia projector. Observational data indicated that most of the Vocational Schools observed did not yet have complete classrooms that supported 21st century learning.

III. Result and Analysis

Supportive school environment is a basic requirement that is very fundamental in succession the implementation of curriculum [16]. This curriculum can only be implemented if the classroom facilities, tools, equipment, and machines are adequate and relevant. Availability of appropriate classroom facilities enhances student learning by allowing them to be involved in demonstrations, and practice which will help them to continue to build their skills [17].

To improve the quality of a classroom in vocational education, the school should give more concern on the learning demand which encourage students' critical thinking, creativity, collaboration, and communication.

a. Critical Thinking

Critical thinking is the ability to think clearly and rationally and to understand the logical relationship between ideas that arise as well as draw reasonable conclusions and making decisions. Besides that this is a challenge for teachers how to provide learning can encourage students to sharpen sharp analysis of problem solving. Critical thinking skills refer to the ability to analyse information objectively and make reasonable judgment [18]. Critical thinking can be related to how to provide training that is able to provide rational freedom for students to solve problems systematically and objectively since this is supported by providing libraries in classrooms / laboratories. The skills needed to be able to think critically, including observation, analysis, interpretation, reflection, evaluation, inference, explanation, problem solving, and decision making. It can be looked at Figure 2.

Figure 2 shows that critical thinking requires supportive space to arouse students' learning enthusiasm both in discussing and solving problems. The room needs flexible access to stimulate students' cognition in directly seeing literacy, tools, and practicum machines that are adjacent to the discussion room. The stimulation will make it easier to criticize all problems and find innovative solutions in dealing with various problems.

b. Creativity

Creativity is the base of development. Creativity triggers curiosity, abstract thinking, innovation, and empathy. Creativity is the interaction between intelligence, processes, and the environment in which individual or group produces products that are clear, new, and useful in social contexts. Creativity can be formed by using perseverance and teamwork as well as spontaneity and self-expression. All of these are important skills in nowadays which is the mass communication and abundance of information [19].

Educators can enhance student creativity in two major ways, namely: 1) Building a learning environment that supports key personal factors (for example, domain knowledge development, creative confidence, sensibility, risk taking). 2) Building an environment that supports creativity conditions (for example, allows the use of physical flexible environments, provides opportunities for exploration, and uses learning practices that support creativity). Teachers can also integrate their learning and teaching activities with the latest information technological development. For example, they need to learn online. The integration of learning with the internet will greatly influence effectiveness in developing student creativity in this digital era [20][21].

Figure 3 explains that the room is able to develop student creativity. Since the students are able to exercise freedom of thought, comfort in interacting, and courage in expressing ideas. The room must be able to provide flexibility as an effort in expressing creative ways and ideas in solving a problem through methods developed by students. The upgrading of digital facilities encourages students to be more active in finding variants of information sources to develop their minds without being co-opted by a fixed method.

c. Collaboration

Likewise, Hesse, Care, Buder, Sassenberg, & Griffin et al. (2015: 38) defines collaboration as an activity of working together towards common goals. Collaboration in working prepares students for facing modern

society since the most complex communal, social, and workplace issues are solved by groups, not individuals. Directing students to work together helps them to recognize the value of the contribution [21].

Figure 4 shows that the school practice space must have space to discuss collaboratively and ensure the students for having freedom of expression and explore cognition. The room is equipped with a discussion table both U-shaped and circular giving benefits in building stimulation of students' creative ideas in problem solving.

d. Communication

Communication skill that is effective is always highly valued. However, being able to share thoughts, questions, ideas, and solutions in ways that can be understood with the changing nature of literacy are skills that are important.

Digital communication needs to be installed for being a medium of communication, especially in making presentations and brainstorming. The room is equipped with a fast internet network. Interactions can occur over long distances even though they are synchronous and asynchronous. The teacher acts as a motivator thus interaction occurs between students.

It is necessary to consider aspects of comfort to improve the spirit of learning for selecting the furniture and equipment. The design of furniture and learning equipment must lead to an ideal embodiment, among others, by taking into account the function, type, quality of materials, engineering (construction), as well as the size of the furniture by taking into account modules, ergonomics, and anthropometry.

As we know at Figure 6 that ergonomics and anthropometrics aspects need to be considered thus the use of furniture can support teaching and learning activities in a healthy, appropriate, and easy way. All shapes, angles, slopes, and sizes of furniture are recommended to suit the size of the user's body, and support the position of the right attitude in each activity. The most important types of furniture are chairs and tables.

Figure 7 explain that the practice room is able to practice with the safety standard both layout of the machine placement, safety of machines and humans, and the machine is made minimalist. Integrated laboratories between planning, production, and product testing represent the world of work in the Industrial 4.0 era [22]. This arrangement is equipped with devices in it that provide accountability, transparency, effectiveness, and efficiency in the management of good vocational laboratories. Based on the results of the FGD and the response of the workshop manager, the analysis conclusions were obtained as follows [5]. Patterns of practical learning in the world of education that have the same laboratory model as the world of industry shape the skills to achieve competence, both attitude, skills, and knowledge. The practice room in the laboratory is also equipped with supervision from each lecturer in each sub-laboratory. Laboratories are also formed the same pattern in the industry. The laboratory floor consists of 3 colors, red work area, yellow border, and green area for supervision of practice and evacuation process in case of accident emergency.

IV. Conclusion

Most vocational schools in Indonesia that were observed did not yet have complete classrooms that supported 21st century learning. It is needed to use digital equipment in the classroom, made from instructional materials, modules and 3D animated videos as well as supporting facilities such as computers as a control center for all learning resources in the classroom (Interactive Instruction Center, Resource & Class Management Server, and Interactive Classroom Server), interconnected multimedia equipment and a strong internet network. Moreover, class characteristics should has writing facilities and teaching equipment that supports 21st century learning. It should has classroom layout, furniture, and room size that is easily changed and easy to be transformed into spaces with functions different (discussion room, consultation room, independent study, research, etc.) The integration of computer equipment, internet and multimedia is needed. Each classroom must have an HVAC system to provide a comfortable learning process as well as low-level electrical plugs spread evenly across the walls of the room, smooth, and flat floors to facilitate furniture rearrangement, lighting that can be adjusted for group discussions, presentations, and video recording.

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Appendix

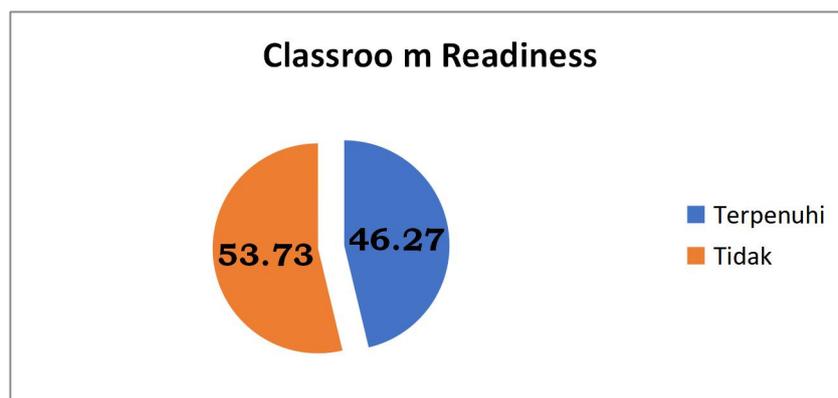


Figure 1. Classroom Facility Readiness for 21st century learning

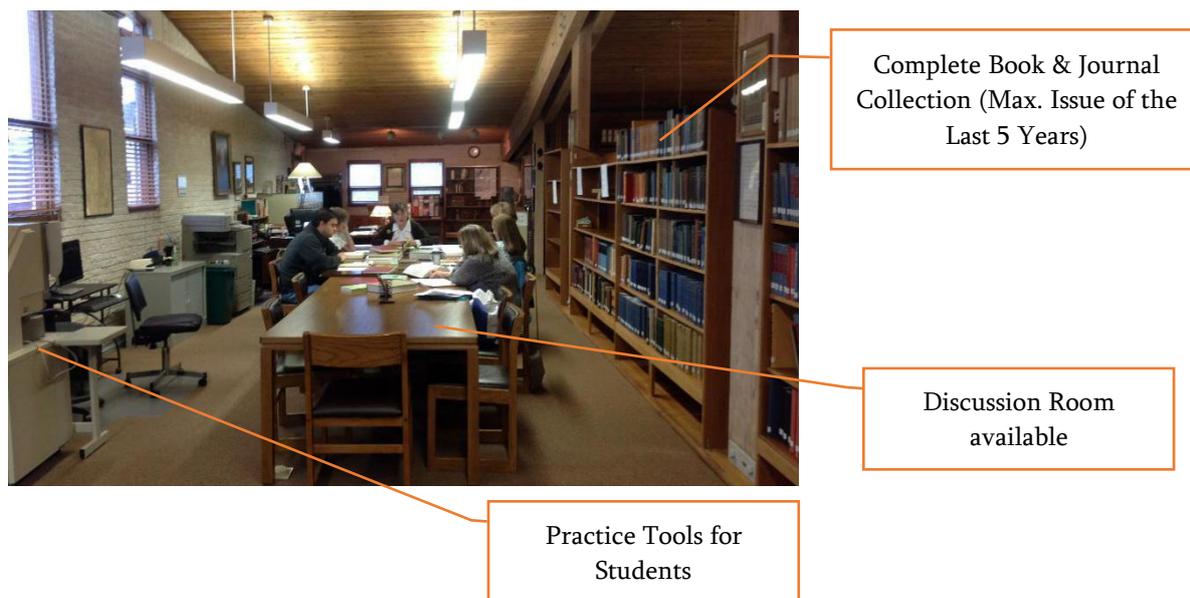


Figure 2. Application of Critical Thinking Oriented Space

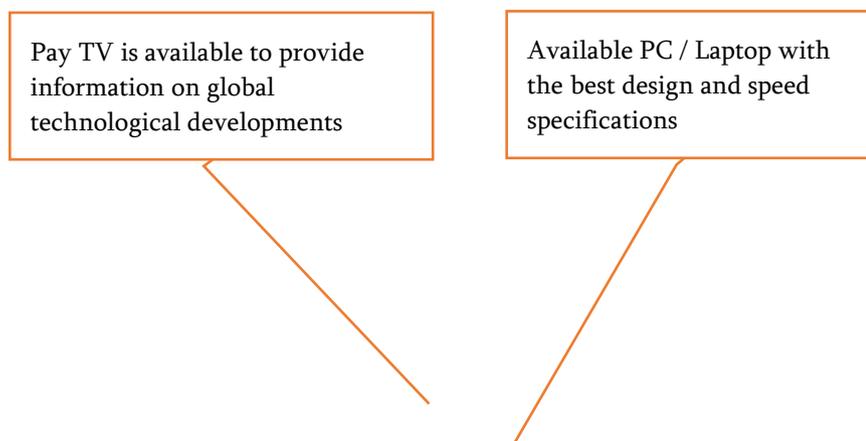




Figure 3. Application of Space Oriented Creative Thinking Skills

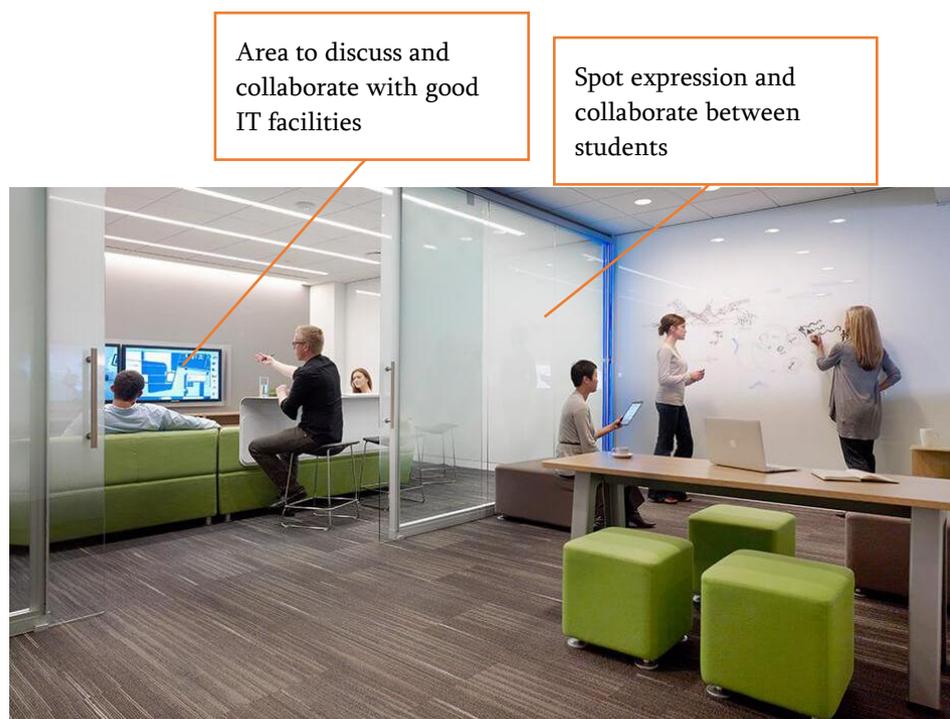


Figure 4. Application of Collaborative Oriented Space

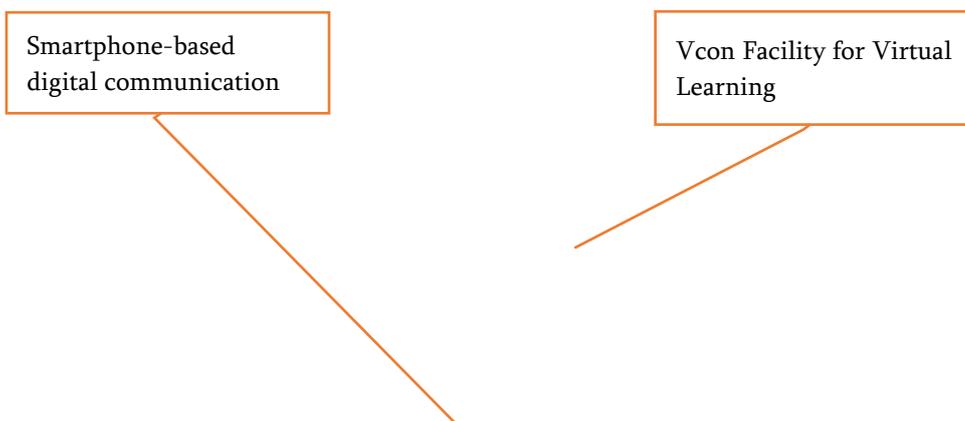




Figure 5. Application of Communication Oriented Space



Figure 6. Vocational Educational Classroom in 4.0 industry Revolution Era



Figure 7. Standard application of industrial machinery production and design representation industry 4.0