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Application of Robot Technology Games in Learning Activities

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Abstract. Students of 8F ICT class in the 7th Muhammadiyah High School of Yogyakarta lack understanding of the assembly process and software connection, resulting in difficulties in comprehending the communication process between robots and their control systems. The purpose of this community service is to increase understanding of electronic components, related understanding of how to stack and assemble a simple set of robots, as well as training in assembly of robotic media and software for communication with robots. The methods employed in this community service involve delivering lectures on robotics in a straightforward manner, providing training in basic robotics, and assessing activities through the use of a questionnaire utilizing a Likert scale for evaluation. Based on the data obtained through activities, it is known that the activities have a positive effect in improving logical thinking skills, creative thinking abilities, problem-solving skills and capacity for teamwork through learning robotics training.In addition, the evaluation of the activity has a score of 83.87% which means that the activity is in the very good category.

1 Introduction

The 7th Muhammadiyah High School of Yogyakarta was established on August 1, 1965. Moetoe Junior School is situated in a tranquil and pleasant environment. Creating a supportive atmosphere for teaching and learning involves ensuring that the surroundings are conducive, calm, pleasant, and effective. This includes locating the learning space away from main highways to minimize the noise generated by automobiles. PM Muhammadiyah 7 is situated in Purbayan Village, specifically at RT 53 RW 13 in Kalurahan Purbayan, Kapanewon Kotagede, Yogyakarta City.

In 1968, the name of Muhammadiyah Kotagede was altered to Muhammadiyah 7 Yogyakarta. In the same year, Mr. Kohari took over from Mr. Muhammad Salman Ja'far as

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the Head of Muhammadiyah 7 Yogyakarta Primary School. He was assisted by Mr. Sugeng Suparto as the Deputy Head of School, Mr. Suhirman as the Treasurer, and Mr. Hadjoewad, Mr. Kamali, Mr. Arsjad AU, Mr. Rahmadi, Mr. Dahrowi, and Mr. Wahzary who were teachers and also part of the Task Force known as Tim-9. Despite facing limited facilities and financial resources, this team of nine motorcycles perseveres as the leading force in addressing school issues.

In 1974, Muhammadiyah High School 7 Yogyakarta transitioned from being a public school to becoming a privately funded institution with assistance. The government offers monetary aid to each student to cover the school's operational costs. Then, in 1976, the status can be changed from aid to subsidy. Prince Mangkubumi conducted the inaugural stone laying ceremony on January 10, 1981, marking the commencement of the construction of 5 rooms for the SME Muhammadiyah 7 Yogyakarta building. The Kridhoharsoyo family constructed the building on their privately owned 2,700 square meters of land situated in the Jeron Boto complex, Purbayan Kelurahan. The property on which this structure stands was allocated to the Kotagede PCM and subsequently designated for the Muhammadiyah 7 Yogyakarta SM. (up to the present day). The development is progressing incrementally. The relocation of the teaching facilities from the original Kotagede silver mosque complex to the jeron boto complex was done gradually, and it was completed by the 1994/1995 school year. The Muhammadiyah 7 Yogyakarta Primary School had a total of 17 classrooms in the year 2000. In 2004, the Mohammadiyah 7 Yogyakarta Secondary School acquired an additional 800 square meters of property to expand its premises. The process of expansion and development is ongoing at present. Undoubtedly, the progress of this school would not be possible without the assistance and backing of the founders who continue to prioritize its growth. In addition to the entire faculty, staff, students, and student guardians who have made significant contributions to the advancement of this institution, resulting in the successful graduation of over 9,000 students to date.

Learning consists of interconnected and interrelated components within a system [1], [2]. In order to do this, it is necessary to effectively manage the integration of interconnected learning curricula inside an educational institution. To ensure the success of the curriculum, it is imperative to enable the government sector to take the lead [3], [4]. The coordination of curriculum management at the institutional or school level should be undertaken by the manager and administrative assistant, with a comprehensive approach that takes into account the MBS and unit level curricula (KTSP) as well as the educational institution's vision and mission. Curriculum management refers to the whole process of joint endeavors aimed at enhancing learning outcomes by emphasizing effort, engagement, and knowledge acquisition for individuals [5], [6]. Curricula can be comprehended in either a limited or expansive manner. In a strict sense, the term refers to all the theoretical and practical instruction provided to students within a specific educational program. Students are expected to follow different curricula, but they will learn more effectively when they have hands-on experiences. Additionally, it is crucial to consider students' attention towards teachers and learning materials to ensure that the curriculum is implemented according to the learning plan [7], [8].

Within the 7 Yogyakarta high school, particularly in the 7A ICT class, students primarily focus on computer-related learning. However, it has been observed that some students lack understanding of the assembly process and software connection, resulting in difficulties in comprehending the communication process between robots and their control systems. Therefore, it is imperative to provide instruction and training in robotics and software design, encompassing cable assembly and robot testing.

The robotic training exercises were undertaken throughout a month to demonstrate the process of resolving agreed-upon difficulties between the participants and partners. This involved referencing existing programs, among other methods. The initial step involved conducting a group discussion forum with the PMP partner, Muhammadiyah 7 Yogyakarta, to identify the issues and requirements of schools in the realm of information technology, particularly in robotics. The subsequent step entailed developing educational materials that are easily comprehensible for high school students. Finally, the third step encompassed the actual implementation of robotics introduction and training. The initial step was undertaken based on the premise that we are currently in an era of rapidly advancing technology, particularly in the field of robotics. The development of a customizable robot necessitates the use of innovation and ingenuity. The second step involves the guide assisting pupils in memorizing the sequence required for robot assembly. The third step involves providing advice and instruction to enhance students' capacity for imagination and originality to facilitate their development of robots in the future. The duration of the three steps spanned a period of one month. Each solution provides different techniques to address the problem of the partner.

2 Methodology

The methods of dedication performed by the service team are shown in Figure 1.
The dedication process is described as follows:

a. Training in robot assembly and software development for interfacing microcontrollers with robots. The sciences form provides training and distribution of tools and components in a collection of robot kits, together with toolsets for assembly.
b. In addition to the free training provided over the years, the youngsters have not successfully adjusted to this robot. The science presented include the support and direct instruction from the faculty of electro-medical technology on how to directly apply the robot according to its specific subject.
c. The establishment of a study group at Muhammadiyah 7 Yogyakarta High School during a period characterized by a high number of disinterested and unmotivated young students. The intended purpose of science is to equip students with the necessary skills and knowledge to effectively navigate and utilize technology, ensuring that they do not lag behind as new technological advancements emerge.
d. Training in comprehending the practicality of cables, connectors, and microcontrollers, along with their links to software. Additionally, understanding the functionalities of each pin on the module and the pin connector with the servo motor. The program equips students with the ability to proficiently assemble robots and establish connections with microcontrollers.
e. The training is capable of giving students the ability to assemble robots and connect to microcontrollers.

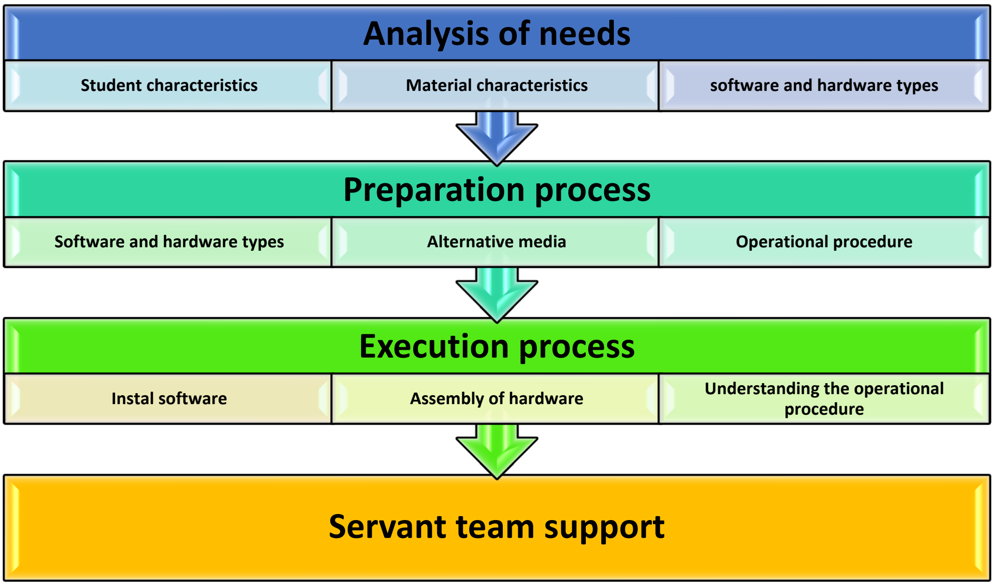

Fig. 1. The flowchart

Furthermore, to assess the level of dedication in activities, students will complete a questionnaire that will then be analyzed quantitatively using a Likert scale. Questions of questionnaire is shown by Table 1.

Table 1. Questions of questionnaire

No	Questions	Options				
		SD	D	N	A	SA
1	The workshop delivered met the students' expectations.					
2	The workshops offered are personalized to the students' interests.					
3	The reorganization of this workshop is necessary.					
4	Workshops provide advantages for students.					
5	The dedication team served well.					
6	The dedicated team possesses the determination and capability to assist and manage anxiety in students.					

Description:
SD: Strongly Disagree
D: Disagree
N: Netral
A: Agree
SA: Strongly Agree

The data analysis will be conducted using a computation approach that employs a Likert scale. The Likert scale is a measurement tool used to assess the perception, attitude, or opinion of individuals or groups regarding a social event or phenomena [9], [10], [11]. The questionnaire offers 5 options for answers. The value of each option will be determined by assigning weights to each option. Weights to each option is shown in Table 2.

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Table 2. Weights to each option

Answer's scale	Value
Strongly Agree	5
Agree	4
Netral	3
Disagree	2
Strongly Disagree	1

3 Results and Discussion

The community service to providing easy robotic assembly training to the community is achieved by the distribution of instructional materials and the use of simulated manufacturing processes for robotic products, such as a robot arm, in group settings. This approach aims to enhance the participants' comprehension and knowledge. The comprehensiveness of comprehension depends on the participants' level of understanding in assembling the robot components and controlling the participant-created arduino system. Delivery of materials by the service team.

After the delivery of the material by the servant team, then the group of students who had previously been distributed directly continued the practice of making a robot arm with the components that had been provided and guided by the service team in its performance so that what the students are doing can be controlled by the process of making it. In addition, students can ask the servants as facilitators when having difficulties when stacking the robot. The purpose of this simulation and practical practice gives positive results towards training access that the students are very enthusiastic about the learning process. In this process, students are trained to focus and be patient in testing highly sensitive mechanical chains if they are wrong in inserting input and output cables into the microcontroller [12], [13]. The process of assembly robot is shown in Fig. 2.

Fig. 2. Assembly of robot

Once the robot has been completed, the subsequent student assesses its functionality to determine if it operates correctly. Each pupil is currently undergoing a highly stressful period due to concerns about the robot's inability to function optimally. Troubleshooting is an essential ability in operating and constructing robots, enabling students to evaluate any malfunctioning components. Additionally, it aids students in maintaining attention and effectively managing any anxiety or apprehension associated with the learning process [14], [15], [16]. In general, the robots created by students perform admirably. The function test is shown by Fig. 3.

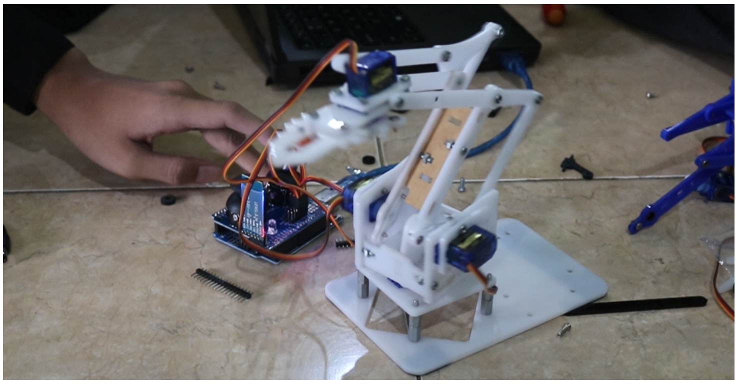

Fig. 3. Function test

Constructing a robot of this nature necessitates the incorporation of certain cognitive abilities, such as logical reasoning, as students are expected to grasp programming languages [17], [18]. Additionally, analytical thinking and problem-solving skills are essential, as challenges may arise during the robot's building process. Certain objects may not function well, prompting students to evaluate and identify the source of the problem [19], [20]. This process enhances their creative thinking abilities, as they are tasked with designing their own robots. The ultimate outcome of this instruction is to acquire that skill.

The assessment of this robotics program is conducted by a questionnaire that is filled out by the pupils. The service team evaluates students based on their comprehension of the provided material, the effectiveness of the delivery techniques, and the overall value of the training. Results of questionnaire is shown in Table 3.

Table 3. Questionnaires result

No	Questions	Options				
		SD	D	N	A	SA
1	The workshop delivered met the students' expectations.	0	0	2	20	9
2	The workshops offered are personalized to the students' interests.	0	0	5	23	5
3	The reorganization of this workshop is necessary.	0	1	3	18	9
4	Workshops provide advantages for students.	0	0	3	21	7
5	The dedication team served well.	0	0	1	19	11
6	The dedicated team possesses the determination and capability to assist and manage anxiety in students.	0	0	3	22	6

The total percentage of answers from respondents can be determined by using the formula (1).

$$Score\ interpretation = Total\ of\ score\ \div highest\ score\ \times 100\% \quad (1)$$

Score interpretation criteria is shown in Table 4.

Table 4. Score interpretation criteria

Amount	Description
0 – 19,99%	Very Bad
20% - 39,99%	Bad
40% - 59,99%	Enough
60% - 79,99%	Good
80% - 100%	Very Good

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Based on Table 3, formula (1) and Table 4, it can be seen that the interpretation score of the evaluation of devotional activities is 83.87% which means this activity is in the category very good.

4 Conclusions

Based on the data obtained through dedication activities, it is known that the activities have a positive effect in improving logical thinking skills, creative thinking abilities, problem-solving skills and capacity for teamwork through learning robotics training.In addition, the evaluation of the activity has a score of 83.87% which means that the activity is in the very good category.

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