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Robotics Workshop to Increase Motivation and Science Literacy of SMP IT Khairu Ummah Rejang Lebong Students

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Abstract

This activity aims to Increase the Motivation and Science Literacy of SMP IT Khairu Ummah Rejang Lebong Students. This activity is one form of implementing the tridharma of higher education. One of the tri dharmas of higher education is community service, this service activity is an activity that every lecturer must carry out, therefore lecturers in the Master of Science program at Bengkulu University collaborated with IT SMP teacher Khairu Ummah Rejang Lebong Bengkulu on September 28, 2024, to carry out service activities at SMP IT Khairu Ummah Rejang Lebong. This collaboration takes the form of community service activities at SMP IT Khairu Ummah Rejang Lebong Bengkulu with the title "Robotics Workshop to Increase Motivation and Science Literacy of SMP IT Khairu Ummah Rejang Lebong Students". From these activities, it can be concluded that the teaching material delivered at the Robotics Workshop uses interactive multimedia which includes lectures, virtual demos, animations, visualizations, simulations and videos which have proven successful in motivating students in the motivated category with a score of 3.84 and increasing scientific literacy in the high category with a score of 3.93.

A. Introduction

Motivation for learning that is not yet optimal can be caused by the way teachers teach that is not yet professional and not proportional. This can cause a decrease in student learning achievement which can be seen in the 2018 National Science Examination In order for students' learning motivation to be increased, it is necessary to carry out activities that involve students actively and significantly. One form of activity is robotics activities at school.

Children in the 21st century are skilled and familiar with using advanced technology in playing, these skills support their use in various technology and communication application systems, especially the use of multi-media and robotics in school learning known as Educational Robots (Astuti et al., 2023; Laksono et al., 2023). Several studies have found that there is an influence of the use of robotics on student learning outcomes in the moral, linguistic, knowledge and social aspects of children (Pashevich, 2022; Vogt et al., 2017). Other findings also report that learning activities become more interactive when using robots in learning (Baxter et al., 2017; Chen et al., 2020). Therefore, robot design and parents' perceptions of the use of robots in schools play an important role in the implementation of robots in learning

In the junior high school curiculum there are intracurricular, co-curricular, extracurricular or independent study activities at home, these activities can be in the form of electronics skills. Robotics activities can be carried out at home or at school, on this occasion the discussion focused on Robot Demonstrations and Simulations to increase students' motivation towards science at SMP IT Khairu Ummah Rejang Lebong.

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This activity was carried out involving teachers and 37 students at the school with the hope that students would be more interested in studying Physics which involves electronics/Robotics material which can be done at school or at home. At school, students are taught how to make robots and to become proficient, students continue their activities at home, so that students can always carry out learning activities at home.

A robot is defined as an automatic controlled manipulator, programmable in three or more axes, reprogrammable, multi-purpose (Mayub & Fahmizal, 2018). The robot can move in a straight line, turn, and make movements at line follower intersections independently. This type of robot can be used as a means of transporting goods by directing it to its destination via a specified line (Phutane, 2021; Truc & Kim, 2017). The control system can be used so that the robot can work according to what is needed. The problem with controlling the robot lies in its stability when observing the trajectorie it reads. For this reason, a type of control system is needed, namely a PID control system and control mapping. The PID control system and control mapping make the robot run with higher accuracy, responsiveness and more stability (Fahmizal et al., 2017). In the line follower robot system, the sensor functions to detect lines so that they follow a path according to the shape and direction of their trajectory. The line color and background color are made to contrast so that it is easy to read, if the background color is white then the line color is made black and vice versa. The working diagram of the line follower robot system is depicted in Figure 1

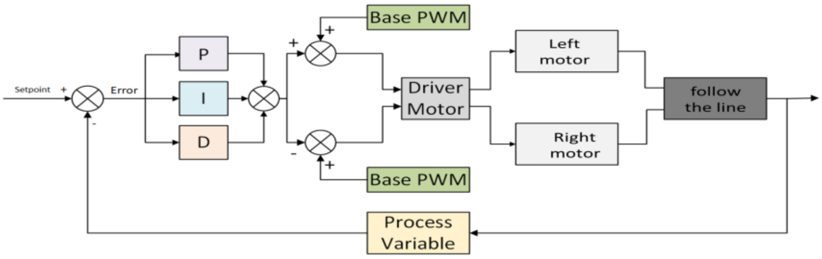

Figure 1. Basic Block Diagram of Line Follower

The FKIP UNIB Masters in Science Study Program always provides community service in the field of physics as well as applications and applied fields of science. In this activity, robotics is discussed, this is done in accordance with the competencies possessed by the teaching staff in the FKIP UNIB Masters in Science Study Program. On 28 September 2024, the Master of Science Study Program at FKIP UNIB received a request from SMP IT Khairu Ummah Rejang Lebong to develop quality science learning by increasing students' interest in science, this was realized in the form of demonstration activities and robot simulations to increase student motivation and literacy in students. Khairu Ummah Rejang Lebong IT Middle School

In this service activity the problem is formulated; What Robotics service materials can increase students' scientific literacy and motivate students' science learning.

B. Methods

In order for a solution to the above problem to be found and the goal of the service to be achieved, a visit was made to SMP IT Khairu Ummah Rejang Lebong Bengkuku to coordinate service activities according to the script requested by the science subject teacher at SMP IT Khairu Ummah Rejang Lebong. The activities are; discussing service activities between the lecturers of the Master of Science study program FKIP UNIB (Prof. Dr. Afrizal Mayub, M.Kom, Prof. Dr. ML Firduas, M.T and Prof. Dr. Aceng Ruyani, MS) with SMP IT Khairu Ummah Rejang Lebong Bengkuku. The service methods carried out consist of;

1. Robotics teaching materials are delivered to students through interactive learning, lectures, discussions, questions and answers, animations, simulations, videos and so on. The robotics material includes simple analog and intelligent robots to relatively sophisticated robots, namely humanoid robots. Providing robotics teaching materials aims to bring science concepts closer to the real world through robotics so that it is hoped that it can increase students' motivation to learn science. The material includes the definition of a robot, the composition of a robot, how a robot works, parts of a robot, how to make a robot, robots for entertainment, robots for health, robots for industry, robots for defense, robots for education and robots for environmental sustainability.
2. To make the robot material easy for students to understand, robot demonstrations are carried out with animations, videos and simulations. The robots on display consist of analog robots, intelligent control robots and humanoid robots.

3. The method employed was a lecture combined with workshop activities on project-based learning. The outreach was conducted in several stages: first, there was a presentation on project-based learning in early childhood education. Next, there was a workshop session on project-based learning for early childhood educators with a theme centered around the ocean, focusing on a project related to a shopping center. The third stage involved presenting the workshop results within groups through role-playing activities.
4. The success indicator for this activity was an 80% increase in educators' knowledge regarding the implementation of project-based learning in early childhood education. The evaluation method utilized in this activity involved distributing pre-posttest questionnaires to early childhood educators before and after the training and workshop on PBL to gauge the success of the activity. Then, the data from the pre-post test results were analyzed using the Wilcoxon Test in SPSS.
5. Robot simulation consists of Inertial Measurement Unit feedback, Inertial Measurement Unit testing without inference, side disturbances, backward disturbances, front disturbances and elevated fields
6. Robot activities with stages (a) explaining the function and components of the robot to students (b) preparing the necessary materials and tools, (c) preparing the robot's trajectory, (d) building and testing the robot (f) evaluating robot errors and correcting them
7. Collect data on student learning motivation towards robotics activities using a questionnaire
8. Collect data on teacher and student responses to robotics activities at SMP IT Khairu Ummah Rejang Lebong

Questionnaire, used to determine students' learning motivation and students' scientific literacy after participating in the Robotics Workshop to Increase Students' Motivation and Science Literacy at SMP IT Khairu Ummah Rejang Lebong

C. Results and Discussion

Lecture

To broaden students' knowledge at SMP IT Khairu Ummah Rejang Lebong Bengkulu about robotics, making robots and the role of robots in the world of education, especially to raise students' awareness of science and the role of robots in life, robotics learning is carried out. The teaching materials in this lesson include the definition of a robot, the structure of a robot, how a robot works, parts of a robot, how to make a robot, the use of robots to help human work and humanoid robots. The place where the service is carried out can be seen in Figure 2, while the title and implementer of the service activity can be seen in Figure 3. The form of material delivery can be seen in Figures 4 and 5.

Figure 2. Location of Service

Figure 3. Lecture Material

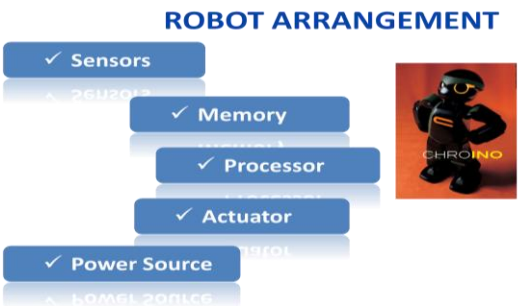

Figure 4. Sample lecture material about arrangement of robots

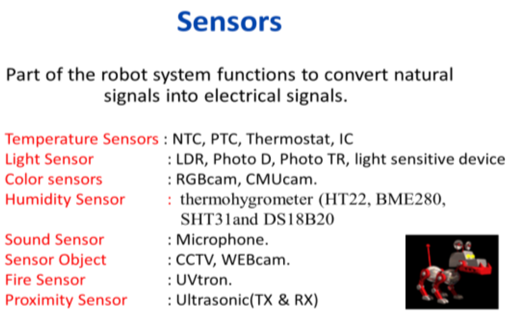

Figure 5. Sample lecture material about sensors of robot

Simulations and videos

Figure 6 shows a picture of a fire extinguishing robot being demonstrated, while Figure 7 shows a fire extinguishing robot being maneuvered.

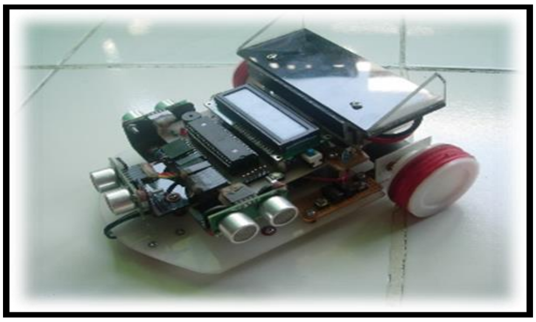

Figure 6. Fire Extinguisher Robot

Figure 7. Screenshots of Maneuverable Fire Extinguisher Robot

The algorithm used in the fire extinguishing robot simulation consists of 2 types of algorithms, first the robot moves towards the source of the fire, then tries to extinguish the fire using a fan. If the fire is still burning, the robot moves towards the fire again and turns on the fan to extinguish the fire. This robot behavior continues until the fire is extinguished.

Figure 8 shows a simulation of the Line Maze Solving robot, while Figure 9 shows a demonstration of the Line Maze Solving robot being maneuvered

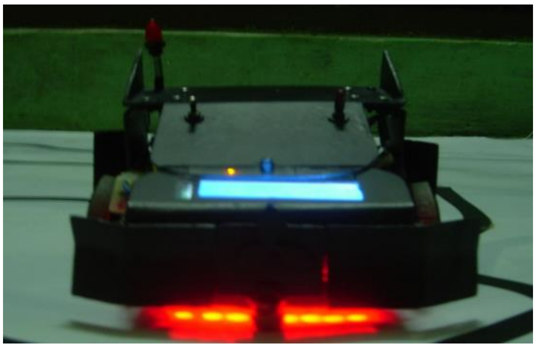

Figure 8. Line Maze Solving Robot

Figure 9. Screenshot of Line Maze Solving Robot maneuvering

The algorithm used by the Line Maze Solving robot to find targets consists of 2 types; (1). Search left, namely; The robot's movement towards the target when it finds the storage always searches to the left until it finds the target, (2) Searches to the right, namely; The robot's movement towards the target when it finds a storage area always traces to the right until it finds the target. When it reaches the target, the Line Maze Solving robot saves memory, so that during the second test, the Line Maze Solving robot that encounters an intersection will not search left or right, because the robot's intelligent memory system will evaluate whether left or right search is not needed to reach the target. See figures 10 and 11

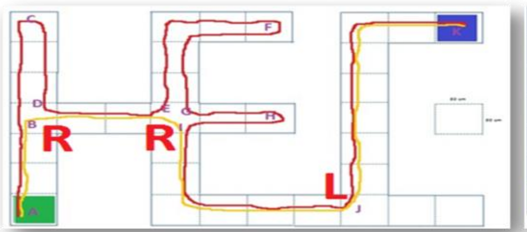

Figure 10. Trace left

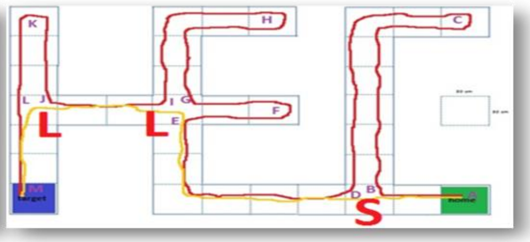

Figure 11. Trace right

The red line is the path the robot takes the first time it passes the yellow line is the path the robot takes the second time it passes, this is done by the robot after saving memory, this proves the robot is intelligent by making the shortest path to reach the target.

Video and Simulation applications

Robot applications can be seen in simulations and videos, including robot simulations of Inertial Measurement Unit feedback, Inertial Measurement Unit testing without inference, side disturbances, backward disturbances, front disturbances and elevated and uneven terrain. Inertial Measurement Unit feedback simulation to see the reaction force of the robot arm balancing the action of changing the direction of the robot's gravity, as in Figure 12. Figure 13 simulates the pressure point of the robot when a disturbance occurs which causes the robot's left palm to receive more pressure than the robot's right palm, so that the red ball point is displayed on the screen. The monitor is visible in the robot's left leg area.

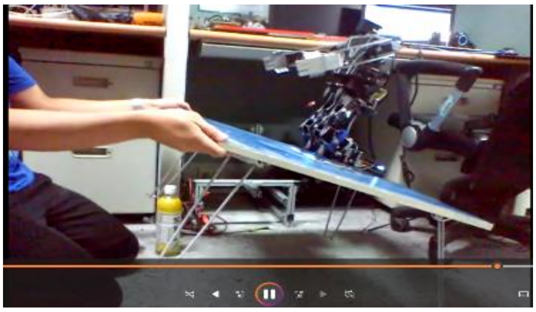

Figure 12. Screenshot video IMU feedback

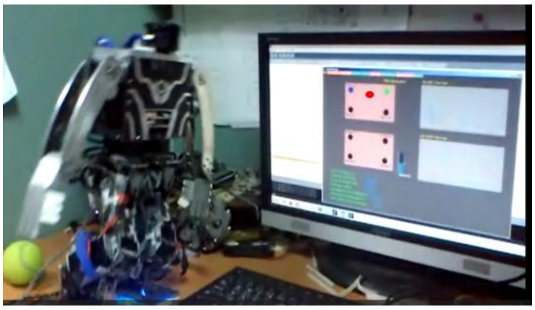

Figure 13. Screenshot video Simulai pushing form side

Student activities include exposure to Robot material and filling out a questionnaire

So that students' love of science can be well motivated, students are involved in lectures and discussions about Robotics

Figure 14. Participants Listening to Robotics Material

Figure 15. Student Participants Filling Out a Questionnaire

Students' Science Learning Motivation and Scientific Literacy after seeing Robot demos and simulations

The criteria used are as follows:

Table 1. Student choice scores

Option	Score
If you strongly disagree	1
if you don't agree	2
if you quite agree	3
if you agree	4
if you really agree	5

Table 2 Categories of Students' Science Learning Motivation and Scientific Literacy based on scores

Score	Score Category Scientific Literacy/ motivation
≤ 1,4	Not very good/motivated
1,5 –2,4	Not good/motivated
2,5 – 3,4	Fairly good/motivated
3,5 – 4,4	Good /Motivated
≥ 4,5	Very good/motivated

Table 3. Recapitulation of Science motivation scores

No	Score	No	Score
1	3.35	14	3.75
2	3.65	15	3.95
3	3.85	16	3.35
4	3.95	17	3.85
5	3.85	18	3.95
6	4.25	19	3.85
7	4.25	20	4.35
8	3.95	21	3.85
9	3.35	22	3.85
10	3.85	23	3.85
11	3.85	24	3.95
12	3.95	25	3.85
13	3.65		
Summary			96.15
Average			3.846
Standard Deviation			0.247

Table 4. Summary of Scientific Literacy scores

No	Score	No	Score
1	3.45	14	3.55
2	4.45	15	3.95
3	3.85	16	3.65
4	3.95	17	3.45
5	3.85	18	3.95
6	4.35	19	3.85
7	4.35	20	4.45
8	3.95	21	3.85
9	3.85	22	4.45
10	3.85	23	3.85
11	3.85	24	3.95
12	3.95	25	3.85
13	3.85		
Summary			98.35
Average			3.934
Standard Deviation			0.282371

The results of the robotics activities displayed in table 3 show that this activity motivates students' learning in the motivated category with a score of 3.846. and increasing students' scientific literacy in the good category with a score of 3,934. This finding supports other findings which say that learning with robots improves learning outcomes, is motivating and fun (Mayub & Fahmizal, 2021). Learning using robots increases children's seriousness in learning, children's socialization and is more positive (Henkemans et al., 2017). Robots can act as friends and companions for children in learning and increase students' insight into the role of robots in life, from conventional robots to humanoid robots (Arents & Greitans, 2022; Javaid et al., 2021). This finding is also in line with the findings of the service carried out at SMK Nurul Iman Palembang by STMIK Palcomtech, Palembang, namely Optimizing the Use of Microsoft Power Point in making Creative Teaching Materials for SMK Nurul Iman Teachers in the New Normal Era can increase teacher creativity and can increase teacher insight in the use of technology is especially important to support learning activities during a pandemic like the current one (Barovih et al., 2021).

D. Conclusion

Teaching material delivered using interactive multimedia which includes lectures, virtual demos, animations, visualizations, simulations and videos has proven successful in motivating students to care more about science in the motivated category with a score of 3,846 and can increase the science literacy of students in the good category with a score 3,934 on a scale of 1 -5. It is best if this service activity is equipped with the practice of making robots directly by students under the guidance of a service instructor.

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References

Arents, J., & Greitans, M. (2022). Smart Industrial Robot Control Trends, Challenges and Opportunities Within Manufacturing. *Applied Sciences (Switzerland)*, *12*(2). https://doi.org/10.3390/app12020937

Astuti, M., Herlina, H., Ibrahim, I., Rahma, M., Salsabilah, S., & Soleha, I. J. (2023). Mengoptimalkan Penggunaan Teknologi Dalam Pendidikan Islam. *Journal Of Social Humanities an Education*, *2*(3), 28–40. https://doi.org/10.55606/concept.v2i3.504

Barovih, G., Handayani, F. S., & Lie, S. (2021). Optimalisasi Pemanfaatan Microsoft Power Point dalam Pembuatan Materi Ajar yang Kreatif Bagi Guru SMK Nurul Iman di Era New Normal. *Dinamisia : Jurnal Pengabdian Kepada Masyarakat*, *5*(5), 1097–1106. https://doi.org/10.31849/dinamisia.v5i5.7065

Baxter, P., Ashurst, E., Read, R., Kennedy, J., & Belpaeme, T. (2017). Robot education peers in a situated primary school study : Personalisation promotes child learning. *PLoS ONE*, *12*(5), e0178126. https://doi.org/10.1371/journal. pone.0178126

Chen, H., Park, H. W., & Breazeal, C. (2020). Teaching and learning with children: Impact of reciprocal peer learning with a social robot on children's learning and emotive engagement. *Computers and Education*, *150*, 103836. https://doi.org/10.1016/j.compedu.2020.103836

Fahmizal, F., Setyawan, G., Arrofiq, M., & Mayub, A. (2017). Logika Fuzzy pada Robot Inverted Pendulum Beroda Dua. *Jurnal Teknologi Informasi Dan Ilmu Komputer*, *4*(4), 244–252. https://doi.org/10.25126/jtiik.201744484

Henkemans, O. A. B., Bierman, B. P. B., Janssen, J., Looije, R., Neerincx, M. A., van Dooren, M. M. M., de Vries, J. L. E., van der Burg, G. J., & Huisman, S. D. (2017). Design and evaluation of a personal robot playing a self-management education game with children with diabetes type 1. *International Journal of Human Computer Studies*, *106*(January), 63–76. https://doi.org/10.1016/j.ijhcs.2017.06.001

Javaid, M., Haleem, A., Singh, R. P., & Suman, R. (2021). Substantial capabilities of robotics in enhancing industry 4.0 implementation. *Cognitive Robotics*, *1*(May), 58–75. https://doi.org/10.1016/j.cogr.2021.06.001

Laksono, P. W., Damayanti, R. W., Rosyidi, C. N., Pujiyanto, E., Jauhari, W. A., & Dwicahyani, A. R. (2023). Perancangan Perangkat Pembelajaran Internet of Things (IoT) dan Pengenalan Robotika Kepada Siswa Sekolah Menengah di Surakarta Sekitarnya. *Jurnal Pengabdian Masyarakat Dan Aplikasi Teknologi (Adipati)*, *2*(2), 87–93. https://doi.org/10.31284/j.adipati.2023.v2i2.4784

Mayub, A., & Fahmizal. (2018). Center of pressure feedback for controlling the walking stability bipedal robots using fuzzy logic controller. *International Journal of Electrical and Computer Engineering*, *8*(5), 3678–3696. https://doi.org/10.11591/ijece.v8i5.pp3678-3696

Mayub, A., & Fahmizal. (2021). Learning Effectiveness of Equilibrium Concept of Objects Through the Walking Stability Bipedal Robots. *Proceedings of the International Conference on Educational Sciences and Teacher Profession (ICETeP 2020)*, *532*(532), 12–20. https://doi.org/10.2991/assehr.k.210227.003

Pashevich, E. (2022). Can communication with social robots influence how children develop empathy? Best-evidence synthesis. *AI and Society*, *37*(2), 579–589. https://doi.org/10.1007/s00146-021-01214-z

Phutane, T. (2021). A Stateflow based Approach for Simulation of Line Following Maze Solver Robot. *International Journal for Research in Applied Science and Engineering Technology*, *9*(4), 1167–1180. https://doi.org/10.22214/ijraset.2021.33883

Truc, N. T., & Kim, Y. T. (2017). Navigation Method of the Transportation Robot Using Fuzzy Line Tracking and QR Code Recognition. *International Journal of Humanoid Robotics*, *14*(2), 1–20. https://doi.org/10.1142/S0219843616500274

Vogt, P., de Haas, M., de Jong, C., Baxter, P., & Krahmer, E. (2017). Child-robot interactions for second language tutoring to preschool children. *Frontiers in Human Neuroscience*, *11*(March), 1–7. https://doi.org/10.3389/fnhum.2017.00073