INTRODUCTION TO MICROCONTROLLER AND PLC TO IMPROVE MINIMAL COMPETENCY ASSESSMENT LOGIC ABILITY STUDENTS OF SMAN 1 LUMAJANG

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Abstract
The Minimum Competency Assessment is one of the national assessments used in 2021 by the Ministry of Education and Culture to replace the high school level national exam. It focuses on measuring literacy and numeric skills through students' logical abilities and reading comprehension. To trigger an increase in logic skills, SMAN 1 Lumajang students are given additional knowledge outside the curriculum. One of them is through the introduction of microcontrollers and PLCs, namely logic-based programming devices. This activity is also able to increase digital, technological and human literacy competencies in the era of the industrial revolution 4.0 because Microcontrollers and PLCs are widely used in the field of industrial automation. From the implementation of the activity it is known that the results of the participants' quizzes on each subject matter showed very satisfactory results with an average score of 76 and the results of the participants' tests at the end of the lesson also showed satisfactory results with an average score. out of 74. In addition, the results of the participant questionnaire in response to the implementation of the activity showed very good results. With these activities, the microcontroller and PLC can be used as one of the extracurricular activities to improve the competence of SMAN 1 Lumajang students.
Keywords : Assesment, Compentence, Logic, Student, PLC.

Abstrak
Asesmen Kompetensi Minimum merupakan salah satu asesmen nasional yang digunakan pada tahun 2021 oleh Kementerian Pendidikan dan Kebudayaan untuk menggantikan ujian nasional tingkat SMA. Ini berfokus pada mengukur keterampilan literasi dan numerik melalui kemampuan logis siswa dan pemahaman bacaan. Untuk memicu peningkatan kemampuan logika, siswa SMAN 1 Lumajang diberikan tambahan ilmu di luar kurikulum. Salah satunya melalui pengenalan mikrokontroler dan PLC yaitu perangkat pemrograman berbasis logika. Kegiatan ini juga mampu meningkatkan kompetensi literasi digital, teknologi dan manusia di era revolusi industri 4.0 karena Mikrokontroler dan PLC banyak digunakan dalam bidang otomasi industri. Dari pelaksanaan kegiatan diketahui bahwa hasil kuis peserta pada setiap materi pelajaran menunjukkan hasil yang sangat memuaskan dengan skor rata-rata 76 dan hasil tes peserta di akhir pembelajaran juga menunjukkan hasil yang memuaskan dengan skor rata-rata. dari 74. Selain itu, hasil kuesioner peserta dalam menanggapi pelaksanaan kegiatan menunjukkan hasil yang sangat baik. Dengan adanya kegiatan tersebut, mikrokontroler dan PLC dapat dijadikan sebagai salah satu kegiatan ekstrakurikuler untuk meningkatkan kompetensi siswa SMAN 1 Lumajang.
Kata kunci : penilaian, kompetensi, logika, siswa, PLC.

INTRODUCTION

The national assessment is a mapping of the quality of education for madrasas, schools and level equivalence programs from elementary to high school. The purpose of the national assessment is a basic mapping of the actual quality of education in the field to assist each school and regional education office in improving the learning process and improving conducive learning conditions. In addition, this policy also aims to provide an overview of the impact of the learning process carried out in each educational unit.

The national assessment consists of three parts, namely, Minimum Competency Assessment (AKM), character survey and learning environment survey. Reporting on the results of the national assessment test contains an explanation regarding the strength profile and scope of improvement in the form of an aggregate score for each school and the regional education office. Students participating in this assessment test were randomly selected from grades 5 SD, 8 SMP and 11 SMA with the aim that students could experience an improvement in the learning process after the assessment.

The government's plan through the Ministry of Education and Culture in 2021 to hold a national assessment, namely the AKM and character survey as a substitute for the national exam at the end of the high school level, has entered concrete steps. This assessment will describe the level of achievement of the competency quality of students so that it becomes an authentic picture of school quality for the Ministry of Education and Culture. The AKM instrument will test logic skills and reading comprehension. The character survey instrument will reflect on a real situation and experience.

AKM focuses on measuring students' literacy and numerical abilities. Based on the 2018 Program for International Student Assessment (PISA) test results, these two aspects of competency are a fundamental problem for students in Indonesia. The low literacy ability of students is also proven by the results of research conducted by Suciati, et al. in 2014 which identified the literacy skills of students in several schools namely, SMAN 5 Surakarta, SMAN 7 Surakarta, SMAN 8 Surakarta, SMAN 1 Sumberlawang, SMAN 2 Karanganyar, MAN 1 Sragen and SMAN 1 Jogorogo through aspects developed by PISA 2000 and PISA 2003 with an average percentage value, namely, content aspects (34.4%), process aspects (32.61%) and context aspects (35.91%).

This Community Service Activity (PKM) was carried out in one of the schools with low student literacy skills, namely, SMAN 1 Lumajang. To trigger an increase in literacy and numerical abilities through logic skills and reading comprehension of SMAN 1 Lumajang students, additional knowledge is given that is not included in the curriculum. One of them is through the introduction of Microcontrollers and PLCs which are logic-based programming devices. This PKM activity was also able to increase student competence in digital science, technology and human literacy in the era of the industrial revolution 4.0 because microcontrollers and PLCs have been widely used in the field of industrial automation.

METHOD

The problem-solving framework for this activity is considered from various aspects, namely, the level of needs and problems, situations and conditions, applied science and technology, owned Human Resources (HR), benefits and level of success to be achieved. To realize this PKM activity in accordance with the problems that have been found, the approach taken includes identification, observation, discussion, outreach, training and evaluation with the following steps,Preparation In order for this PKM activity to run well, the preparatory steps are as follows, Identify schools that will be involved as PKM partners, namely, SMAN 1 Lumajang. Observing activity objects, namely, students of SMAN 1 Lumajang to obtain the data or information needed, among others, namely, lessons, grades, schedules, etc. Conduct discussions with the implementing team, and activity instructors and accompanying school teachers to determine the activity mechanism Determining the participants, namely, 11th and 12th grade students of the Science Department, 15 members of extra robotics at SMAN 1 Lumajang Determination of the material along with the duration to be delivered includes features, architecture, programs, interfaces, applications and troubleshooting Prepare the required documents, modules, materials and devices Develop a schedule for the implementation of activities Conduct outreach to PKM partners regarding the implementation of activities. Implementation This activity is carried out online and offline with interactive media through Google meet and face to face because it is still under the conditions of the COVID-19 pandemic with a duration of 12 hours for 2 (two) days. The method used is lecture and question and answer as well as simulation and direct practice with the following mechanism, Software and installation procedures are provided via flashdisk Materials and exercises are given as scheduled via Google Meet and face to face Participants studied the material and exercises before the question and answer session on the material Question and answer session on material between participants and instructors through Google Meet and face to face At the end of each material section, participants must answer a quiz via Google Meet At the end of the activity, participants must take a test via Google Meet and fill out a questionnaire through the Google Form media.

RESULTS AND DISCUSSION

This PKM activity was carried out for 2 (two) days on 3 and 10 September 2022 at 08.00-14.00. Implementation online on September 3 2022 via Google Meet with participants present at the Multimedia Laboratory of SMAN 1 Lumajang and offline on September 10 2022 at the Multimedia Laboratory of SMAN 1 Lumajang.

Figure 1. Online Implementation

The material is provided in the form of slides (.ppt), documents (.pdf) and interactive videos with the subject matter divided into 3 (three) sections as follows,

Part I : Arduino uno microcontroller

Part II : Omron CJ1M PLC overview, system configuration, communication and addressing , I/O (Input - Output) connection and wiring, basic instructions

Part III : HMI (Human Machine Interface) design, software interfacing, problem and fault diagnostics.

The material was delivered for 12 hours by 2 (five) instructors from Surabaya State Shipping Polytechnic (PPNS) educators. Computers or laptops used by participants must have at least the following specifications: Processor recommendation by Microsoft Memory recommendations by Microsoft Operating system Windows 7/8/10 32/64 bit Minimum storage capacity of 6 GB Screen resolution 1024x768 16 bits RS-232C/USB/Ethernet port communication.

In order for the minimum specifications of the computer or laptop to be fulfilled, SMAN 1 Lumajang provides facility assistance for all participants so that the activities run well and smoothly. All of these activities were carried out at the Multimedia Laboratory of SMAN 1 Lumajang while maintaining and complying with the COVID-19 health protocol.

On the first day, the subject matter of Part I given to the participants included introduction to Microcontroller and PLC devices including hardware and software, system configuration including power supply arrangement, CPU, digital and analog I/O modules, communication including connection systems with computer or laptop, and addressing includes address settings according to system configuration.

On the second day, the subject matter of part II given to the participants included I/O connection and cabling systems including a series of sensor and actuator sinking and sourcing methods, and basic commands including logic bits, set, reset, keep, timer, counter, move and compare, HMI design includes screen, color, text, buttons, lights and timer, software interface includes ladder diagram connection with HMI, and fault and problem diagnosis includes hardware and software.

In addition to studying the material provided, participants were given exercises to work on independently. Participants are also given the opportunity to ask and answer questions with the instructor regarding the material that has been studied. As a form of evaluation of this activity, participants are quired to answer a quiz given at the end of each material section and a test given at the end of the activity.

Figure 2. Offline Implementation

The quiz questions given are in the form of multiple choice and the test questions given are in the form of interactive simulations. All material, quizzes and tests are provided through Google Meet media which can be accessed by all participants.

From the quiz results, all participants in the 3 (three) main sections of the discussion showed quite satisfactory results with an average score of 74. From the test results of all participants at the end of this activity, it was seen that the results were quite satisfactory with an average score of 76. This shows that actually the students of SMAN 1 Lumajang have quite good literacy and numerical skills.

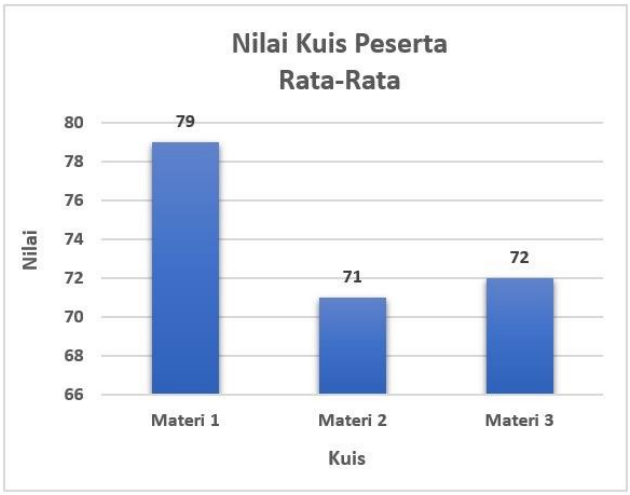

Figure 3. Average Participant Quiz Score

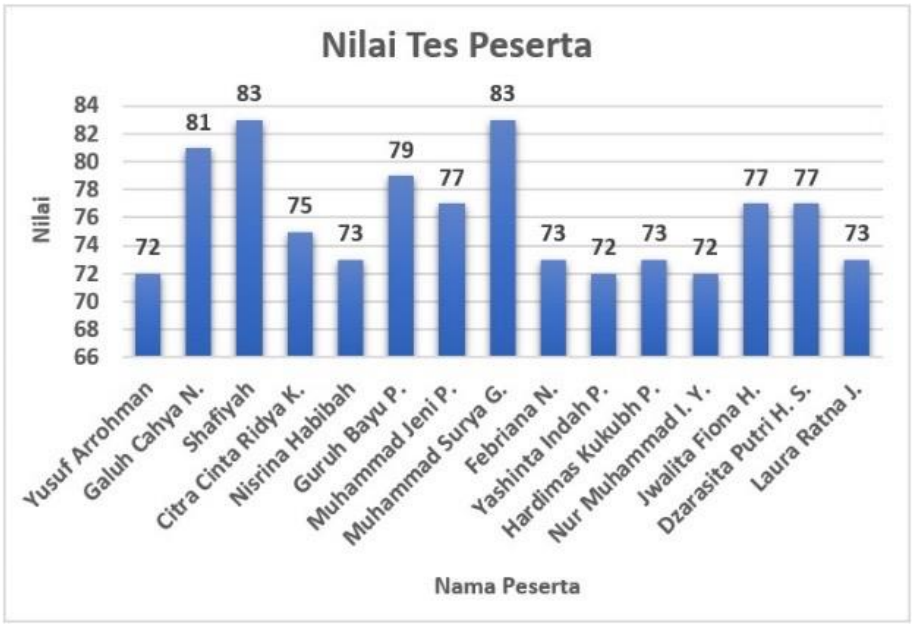

Figure 4. Participant Test Scores

At the end of this activity, all participants are required to fill out a questionnaire through the Google Form media as a form of response or feedback from the implementation of activities including the systematic content of the material, the ease of understanding the content of the material, the method or technique of delivering the material, the allocation of time for delivering the material, the interaction between the instructor and the participants, the ability of the instructor, allocation of question and answer time on materials, methods (media, facilities, mechanisms) and benefits of activities.

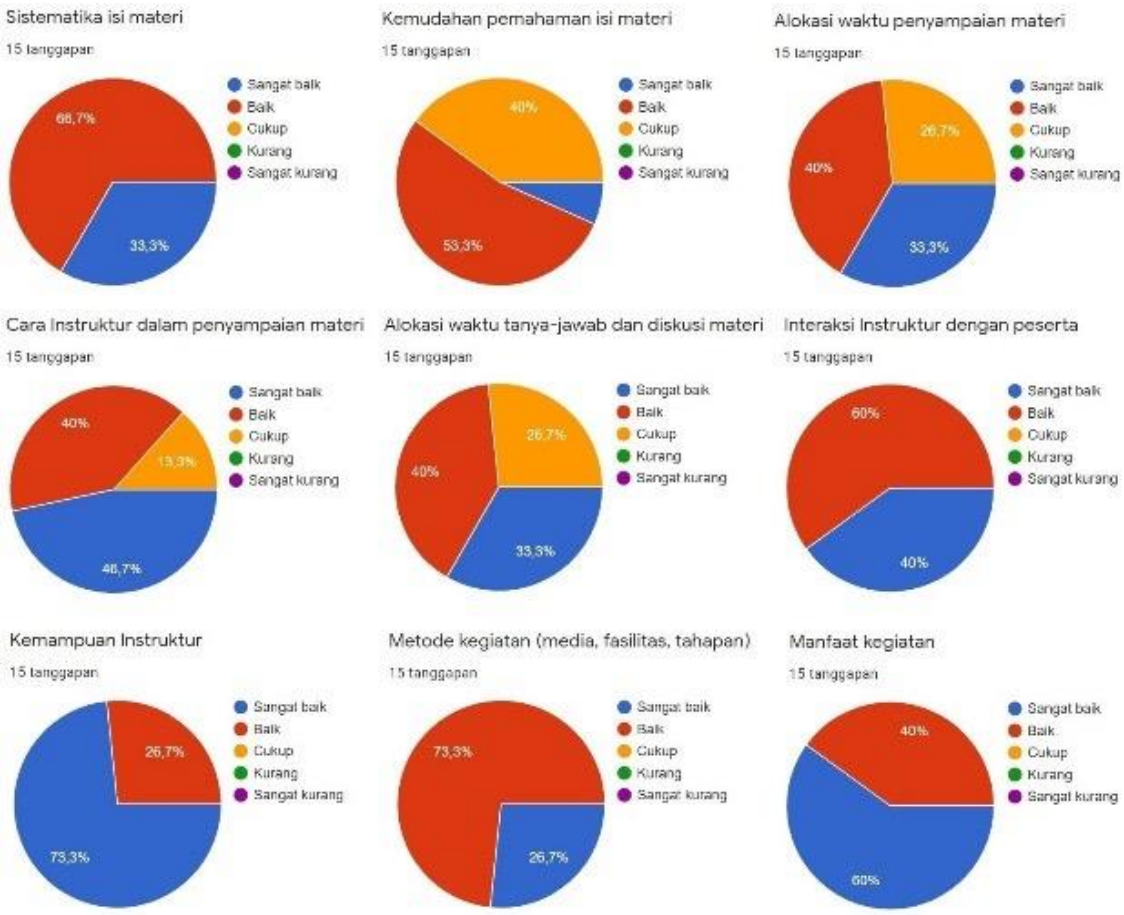

Figure 5. Participant Questionnaire Results

From the results of the questionnaire that had been filled in by all participants, it was seen that the results were good. Input in the form of suggestions obtained from the results of the questionnaire, namely, the lack of time allocation when delivering material. This is due to limitations in the conditions of the COVID-19 pandemic so that all material cannot be delivered. In addition, this activity was also able to provide participants with an overview of HR competencies that must be possessed in the era of the industrial revolution 4.0.

In order for students' literacy and numerical abilities to be measured, it is hoped that further training activities will be carried out because this activity is only a trigger for increasing literacy and numerical abilities, especially logic skills and reading comprehension of SMAN 1 Lumajang students. This PKM activity was carried out well thanks to the collaboration between the PPNS Research and Community Service Center and SMAN 1 Lumajang, especially the accompanying school teachers who have helped and contributed a lot.

CONCLUSION

From the results of the implementation of the activities that have been carried out, the following conclusions are obtained, Activities have been carried out properly in accordance with the objectives, namely, increasing literacy and numerical abilities through logic skills and reading comprehension of SMAN 1 Lumajang students. The activity was attended by 15 students of SMAN 1 Lumajang and facilitated by SMAN 1 Lumajang and carried out online due to the COVID-19 pandemic with a duration of 12 hours for 2 (two) days from 3 and 10 September 2022. The results of the participants' quizzes on the 3 (three) subject matter sections showed satisfactory results with an average score of 74. The final test results of the participants showed satisfactory results with an average score of 76. The results of the participant questionnaire as a form of response or response from the implementation of the activity showed good results.

SUGGESTIONS

From the results of the implementation of the activities that have been carried out, suggestions for improvement for the implementation of activities in the future are obtained as follows, Microcontrollers and PLCs can be one of the extracurricular activities to trigger an increase in literacy and numerical skills through logic skills and reading comprehension of SMAN 1 Lumajang students. Further training activities are needed so that students' literacy and numerical abilities can be truly measured, for example numeracy literacy training through the GLN (National Literacy Movement) program. Microcontrollers and PLCs can be one of the activities that provide an overview of HR competencies needed in the era of the industrial revolution 4.0. Not all material could be delivered due to limitations in the conditions of the COVID-19 pandemic so that in the future it can continue with material on an ongoing basis through the Surabaya State Polytechnic Shipping Center for Research and Community Service.

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