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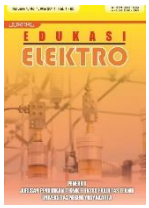

Development of a Project Based Arduino Uno R3- Assisted Robotic Training Design

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Abstract— This type of research and development aims to create designs and products for robotics training, as well as robotic training design feasibility through expert validation and evaluation by respondents. Based on a survey of 49 people surveyed, 28.3% said they did not master the microcontroller material, 10.8% said they had learned it very well, and 17.4% said they didn't know. This suggests that a lower level of competence compared to the SKKNI makes robotics training necessary. A self-training model is used for this training. The study uses a branch version of the ADDIE development model, which is carried out in five stages: 1. analysis, 2. design, 3. development, 4. implementation, and 5. evaluation. This media produces starter kits and video learning, The ADDIE method is a research method that runs from the stage of analysis to its evaluation, the analysis researchers must know the gap of competence from students to industry, search for intuitive needs, make the need and the gap into the design of training until the last evaluation process, this is finally the reason why Addie is used in this research. Students of SMKN 1 Cilegon and students of Professional Education Electrical Engineering Universitas Sultan Ageng Tirtayasa were used in this research. The analytical techniques used are qualitative and quantitative descriptive analysis. Evaluation results from starter kits, learning videos, and learning materials are used to determine the level of eligibility for robotic training designs. The results of the starter kit evaluation showed that the media starter kit was in the category "Very Fit" with an average score of 40.7 with a range x>33. In the respondent assessment, it was known that the average rating of the nineteen respondents was 60.3 with the range x >51, suggesting that the Arduino Uno R3 project-based robotic training design containing a starter kit, video learning modules, and learning materials belonged to the category of "Very Feasible." In other words, this robotics training deserves to be done.

Keywords: training, robotics, self-directed learning, starter kit.

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1 Introduction

Talking about education can't go away from learning because everybody's been learning from birth. Besides, education has three essential elements: teacher, student, and environment. In education, too, there is an educational system that affects educational outcomes. Training designs for vocational education are still sporadic in Indonesia, unlike other massive sciences. In contrast, vocational training is directed at science two that can be directly implemented in the world of work, so the author designed this robotic training. Based on a survey conducted (Davies 2020) found that 61% of a total of 4,000 people surveyed from the US, the UK, Taiwan, Japan, and South Korea believe that society will be better with increased automation and AI (Artificial intelligence). In this decade, robotics is highly embedded and thought to be very helpful to society [1]. Based on a survey conducted as a preliminary study of 49 students and students with robotic relevance, 28.3% said they had no mastery of the microcontroller material, 10.8% said they were very mastery, and 17.4% said that they did not know, while his back industry wants his employees to meet the competences in SKKNI. From that, robotic training design became one solution.

2 Literature Review

2.1 Self-Directed Learning

According to Curtis J. Bonk (2014), self-learning, also known as self-direct learning, is when one attempts to learn on one's own, with or without the presence of a teacher. Using the Self-Directed Learning (SDL) learning model, students can participate as controllers of the learning process in finding, organizing, and determining what they learn. This is different from learning on its own because teachers still act as the controllers of learning and are responsible for managing and providing the material [2]. Some of the advantages of self-directed learning are as follows:

a. Students have the freedom to choose their style, speed of study, and the direction of their interests and talents.
b. It emphasizes broader learning sources, including teachers and other learning sources that meet the element of education.
c. Students can extend the knowledge, expertise, and capabilities they currently have. Besides, independent learning is a more enjoyable experience [3].

2.2 Vocational Education

Vocational education is designed to meet the needs of the industry and prepare students to work professionally in a particular field [4]. Vocational education is education that refers to the mastery of specific applied skills. Thus, the more practical the applied education you get, the more valuable it is [5].

2.3 vocational education curriculum

The vocational higher education curriculum must be well designed so that students can learn as effectively as possible and fulfill their potential as intelligent, skilled, and moral persons [6].

2.4 Training

Training and development are an effort planned by an organization to improve the knowledge, skills, and abilities of its employees [7]. Training is an effort to acquire knowledge, skills, and attitudes that can be used to improve performance. A training program is effective if

it provides a student or participant with the necessary knowledge, skills, and attitudes. Human Resource Development (HRD), an institution should include training. Implementing training programs is expected to enhance human resources' knowledge, abilities, and positive attitudes, all of which are valuable assets for the organization. Thus, training is an attempt to raise personal standards. Furthermore, such training must be practical for students or other individuals receiving training to develop [8]. In other words, training is defined as an activity in which the management duties of education and training, including the components of planning, arranging, controlling, and evaluating educational and training activities, are fully covered [9].

2.5 Factors Affecting Training Effectiveness

Several factors need to be considered and play a role in training and development.

a. Reactions: An effort to discover the reactions in the form of participants' opinions about training program activities. This effort was made to find information on the participants' satisfaction level.
b. Learning: Learning factor to find information on how training participants master the planning, expertise, and benefits during the activity.
c. Behaviors: the nature of the participants at the time of the training, from the moment of opening to the end of the training, can be seen with the changes in the training participants after the training program.
d. Organizational: gathering information to test the effect of training on a working group or organization in depth.
e. Cost Effectiveness: used to determine the cost range used in the training program [10].

2.6 Instructional Media

Learning media is a medium that conveys a message or information that contains the purpose or purpose of learning and can be used during the learning process. Learning media is essential to help students acquire new knowledge, abilities, and skills [11]. There are three kinds of learning media: (1) teaching aids, (2) teaching tools, and (3) learning resources. On the other hand, some media are concrete, such as truths (board, book, etc.), and abstract, like the teacher's voice, content load, etc [12].

The use of learning media is not an additional function but has its function as a means of helping to realize a more effective learning situation. Learning media is an integral part of the entire learning process. It contains the understanding that teaching media is one of the components that does not stand alone but interrelates with other components to create the expected learning situations [13].

2.7 Learning Video

Learning video is a visual audio medium that can channel messages and stimulate the learner's mind, feelings, attention, and will encourage a deliberate, targeted, and controlled learning process. The messages presented are factual (essential events) or fictional (stories) and can be informative, educational, and instructional [14]. Learning videos have the advantage of witnessing an event that cannot be seen in person and dangerous or past events that cannot be brought directly into the classroom. Students can also play back the video according to their needs. Learning with video media grows my interest and motivates students always to pay attention to the lesson [15].

2.8 Arduino Uno R3

Arduino is hardware and software for anyone to prototype a microcontroller-based electronics series [16]. The software is called the Arduino IDE (Integrated Development Environment), which helps create a program, compile it, and upload it into the ATMega IC. The software generates hex files from various program instruction codes that use the C language and names the sketch after compiling with a verify/compile command [17]. In this modern age, Arduino is widely used as a microcontroller because of its ease of use. This circuit board with a chip can be inserted into an instruction or program to perform many tasks. Its principle is from a computer program to its hardware. Arduino is one of the functions that read information from input devices such as ultrasonic sensors and potentiometers, and it can also send data to devices that are used as outputs, such as LEDs, LCDs, and others. On Arduino, some components merge and make Arduino work as a microcontroller. The Arduino software has two main parts.

a. Command Area: This area has menus such as files, edits, sketches, tools, verification icons, etc.
b. Text area: This section serves to write code using a simple version of C++ [18].

2.9 Learning Media Evaluation

According to Kirkpatrick, evaluation has four levels: Reaction, Learning, Behavior, and Result. In this study, using the first level of reaction, evaluation of participants' reactions means measuring the level of satisfaction of participants with the planned activities. Evaluations at level 1 do not measure what the participants have learned but measure the interests, motivations, and levels of attention of the training participants. The things that can be measured in this stage are:

a. Material relevant to the type of work.
b. Presentation of exciting material.
c. Quality of instructors.
d. Effective visual audio aids [19].

3 Research Method

Research conducted by [20] with the title “Development of the Design of the Infographic Training Program for Officers of PT Pelindo III (PERSERO) SURABAYA” This training is aimed at the staff managing the administrative of the company. The design of this infographic training program has three materials that will be taught to the training participants, namely the infographic concept, the type of infographic and the communication infographic design. Based on the results of the validation of the training design experts, the design of the infographic’s training program has a purpose that is already in line with the needs of employees and companies. In the test conducted by the managerial officer level 9-14 PT Pelindo III (Persero) with a total of 50 people with 10 questions. From the results of the test candidate participants obtained a result of 91.9% [20].

The research carried out by [21] with the title “Google Workspace for Education Training through Project Based Learning for High School Teachers” uses. Methods used in community service activities are presentations, interactive discussions, demonstrations or practices, guidance and exercises. The evaluation method is performed with project-based assignments after the material is displayed by the source to measure the participants' ability to create English language learning materials using Google Classroom, Google Slide, Google Form, and Google

Docs. Then, Google Trainer and the P2M team conducted a review of the task and the results were discussed jointly. The evaluation of activities is also carried out by reporting dedication activities to the community and reporting the evaluation results of the participants, publishing digital modules, video activities and video tutorials to the target community as material for self-learning, as well as publishing video tutorial to the public through social media to reach a wider audience [21].

Research conducted by [22] The robotics and Arduino basic training activities are carried out using the methods of training discussion, assignment, practice, or simulation. As for the data collection technique in the form of a questionnaire given at the end of each meeting used to improve the quality of the training, simulation, and support that we do and measure to any extent the learning methods, the learning resources used by the instructors are beneficial to the participants, as are the composition of the theory and practice given to participants [22].

Table 1. details and specifications on relevant research

Researcher	Aspects			
	Methods / Models	***Digital Media***	***Module***	***Course/ Training***
[20]	ADDIE	×	√	√
[21]	presentation, interactive discussion, demonstration or practice, guidance and practice	×	×	√
[22]	discussion training, assignment and practice or simulation	×	×	√

In the previous three studies, there were some shortcomings, such as the learning medium as its supporter was nonexistent, the limitation of time, and the material provided little because of the time limitation. Then, to update the previous research, a design of robotic training with a self-directed learning method was made with a media starter kit, which contains components for stacking, learning modules, and video learning integrated barcodes on the learning module with 13 materials provided.

This research uses a research and development approach; the ADDIE Branch development model is a product development concept that includes analysis, design, implementation, application, and evaluation. Data collection is used to obtain research information. This research uses questionnaires or lifts, documentation, and literature studies to gather data.

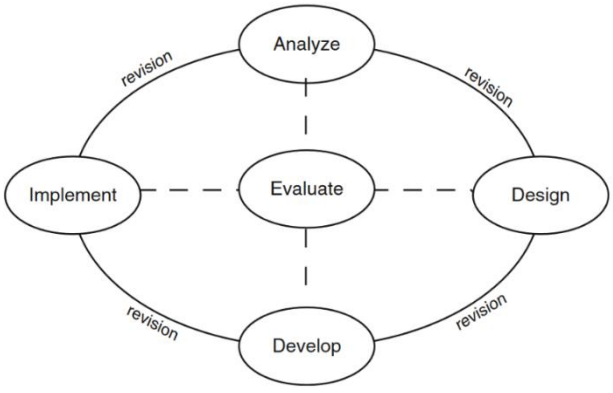

Fig. 1. ADDIE concept

The development of a robotic training design supported by Arduino Uno R3 based on this project adapted the model ADDIE by Branch, and in its systematic processes, there are several processes, there are Analyze, Design, Development, Implementation, and Evaluation. The five aspects of the ADDIE model above are described in Table 2.

Table 2. General instruction design procedures organized by ADDIE, from the analysis stage to the evaluation

	Analyze	Design	Development	Implementation	Evaluation
Concept	Idenftify the probable causes for a performance gap.	Verify the desired performances and appropriate testing methods.	Generate and validate the learning resources.	Propare the learning environment and engage the students.	Assess the quality of the instructional products and processes, both before and after implementation.
Common Procedure	1. Validate the performance gap, 2. Determine instructional goals, 3. Confirm the intended audience, 4. Identify required resources, 5. Ddetermine the potential delivery system (including cost estimate), 6. compose a project management plan,	7. Conduct a task inventory, 8. Compose performance objective, 9. Generate testing strategies, 10. Calculate return on investment,	11. Generate content, 12. select or develop supporting media, 13. Develop guidance for the students, 14. Develop guidance for the teacher, 15. Conduct formative revisions, 16. Conduct a pilot test,	17. Prepare the teacher, 18. Prepare the student,	19. Determine evaluation criteria, 20. Select evaluation tools, 21. Condut evaluations.
	Analysis summary	Design brief	Learning resources	Implementation strategy	Evaluation plan

This table explains the points that should be in the research, as in the analysis section, there should be a gap in competence analysis between students and the needs of the industry. In this study, using the equation formula of Mardapi to define the average score of the validation results and also the responses of the respondents to four times the assessment of the design of this training [23].

Table 3. Score Conversion Result to Scale Four Score

Score Range	**Value**	**Category**
X≥X+ 1.SBx	A	Very worthy
X+1.SBx >X≥X	B	Worth it
X >X≥X- 1.SBx	C	Quite worthy
X≤X – 1.SBx	D	Very unworthy

The following is known:

Average Score = $x\ \frac{\sum x\ (Answer\ Score)}{n}$ (1)

Minimum ideal score = $\sum number\ of\ queries\ x\ Low\ Score$ (2)

Maximum ideal score = $\sum number\ of\ queries\ x\ High\ Score$ (3)

SBx = Default scores for all respondents

SBx = $\frac{1}{6}$ (Max Ideal Score – Min Ideal Score) (4)

SBx = $\frac{1}{2}$ (Max Ideal Score – Min Ideal Score) (5)

4 Research Result

4.1 Analyze

This section provides initial knowledge about why this training is necessary, what kind of training is needed, and the development of robotic training. In addition, the subjects of this research are students and students of SMEs with different levels of education. First, identify existing problems and collect data to identify information gaps between learning processes and industry standards. (SKKNI). This was done through an online survey distributed to students and students whose fields of interest were related to or related to the training provided by the curriculum. The result was that as much as 28.3% of respondents have not mastered microcontroller material, which in this case is part of robotics science, whereas 43.5% are masters, 17.4% do not master, 10.8% are very masters, and only 10 percent are entirely masters of this material. Besides, as much as 28.3% of respondents are highly mastered, 54.3% are masters, 19.6% are still masters, and 13% are not masters of related material for sensors. The analysis is based on studying the Indonesian National Employment Qualifications Standard (SKKNI), the Merdeka Curriculum, and the Electrical Engineering Untirta Vocational Education Curriculum.

The first is the identification of the list of work units in the processing industry category of the machinery and equipment industry that cannot be classified elsewhere in the field of mechanical engineering:

a. Create a programmable logic controller/microcontroller program based on the process mechanism of the equipment/machine, with unit code C.28MEK03.002.1.
b. Scatter components of microcontroller equipment, with unit code C.28MEK03.003.1.

Next are the results of the analysis of the PVTE curriculum 2019. Untirta obtained the ability to learn as follows:

a. Knowledge to identify, formulate, and solve problems implementing electrical power systems or industrial automation oriented to industry 4.0 with code P7.
b. Apply logical, critical, systematic, and innovative thinking in the context of developing or applying science and technology in electro-engineering with code KU4.

The third category of the computers, electronics, and optics processing industry is based on the following units:

a. Installing electronic components on PCBs manually, with unit code C.26EPP00.004.1
b. Installing cable or wiring assembly of electronics with unit number C.27EPP0000.007.1
c. Installing mechanical and electrical components in electronic work units with Unit code C.26.EPP.009.1
d. Finally, designing an electronic network on DC motor control systems with Unicode C.27.EPP.034.1

At the end of phase B, the pupil was able to identify the shape of a robot in everyday life using sensors and could create a robotics project that embodies a sensor on a smartphone with both mechanically and electronically sophisticated constructions, as well as presenting the results of his work. In the problem analysis phase, there are gaps in the learning process and the industrial world. To support the improvement of competence in students and after identification then, this training criteria is students, students, and community aged 15-23 years with relevance in the field of robotics and have basic competence in basic electronics or electrical networks.

4.2 Design

The next stage is the planning of the curriculum design and the design of the learning media to support the teaching activities.

a. Curriculum Design

In the process of designing this curriculum, the materials and also the learning objectives were formulated according to the curricular analysis results, namely SKKNI Field of Electronics prototype and programming in 2019, SKKNI Field of Mekatronics in 2018, PVTE Curriculum CP Untirta 2019, and also CP Curricula Merdeka of Applied Robotics. The content of the problem is shown in Table 4.

Table 4. Content and Learning Purpose

No.	Subject Title	Competence/Objective
1.	Robotic Identification	Training participants learn and understand the Robot Definition after reading the modules in this chapter 1. Training participants learn and understand the characteristics of robots after reading the modules on this chapter 1. Training participants learn and understand the classification of robots after reading the modules in this chapter 1
2.	Robot system	Training participants learn what a robotic system means after reading chapter 2 module. Training participants learn and understand the various elements that shape robotic systems after reading chapter 2 modules.
3.	Microcontroller	Training participants learn and understand what a microcontroller is after understanding the material in this chapter 3. Training participants learn about the use of microcontrollers in various fields after understanding the material in this chapter 3. Training participants learn and understand the history of the microcontroller after understanding the material on this chapter 3.
4.	Arduino	Training participants learn the history of Arduino after understanding the material in this chapter 4. Training participants learn the types and specifications of Arduino after understanding the material in this chapter 4.
5.	Arduino Ide	Training participants learn the Arduino IDE software after understanding the material on this chapter 5. Training participants can install the Arduino IDE Software after understanding the material and following the steps on this chapter 5. Training participants can learn about the functions of the Arduino IDE software after understanding the material in this chapter.
6.	Ultrasonic Sensor	Training participants can recognize LCD 16 X 2 and also ultrasonic sensors from specification to work system after understanding the material on this chapter 6. Training participants can program and stack 16 x 2 LCDs, and Ultrasonic Sensors after understanding the material also see the learning video that is integrated into this chapter 6.
7.	PIR Sensor	Training participants recognize the Passive Infrared Receiver (PIR) sensor after reading the material on chapter 7 and watching the learning video integrated into the module. Training participants can program and stack the Passive Infrared Receiver (PIR) sensor after reading the material on chapter 7 and watching the learning video integrated into the module.
8.	Flame Sensor	Training participants get to know the Fire Sensor from the operating system to its user after reading the material on chapter 8 and watching the learning video integrated with the module. Can program and stack Fire Sensors after reading material on chapter 8 and watching learning video integrated with the module.

No.	Subject Title	Competence/Objective
9.	DC Motor	Training participants get to know the DC Motor from the operating system to its user after reading the material on chapter 9 and also watching the learning video integrated with the module. Training participants can program and stack DC motors after reading the material on chapter 9 and also watch video learning integrated with the module.
10.	Servo Motor	Training participants get to know the Servo Motor from the operating system to its user after reading the material on chapter 10 and also watching the learning video integrated with the module. Training participants can program and stack a series of Motor Servo read materials on chapter 10 and also watch the integrated learning video modules.
11.	Joystick	Training participants recognize the Joystick from the operating system to its user after reading the material on chapter 11 and watching the learning video integrated with the module. Training participants can program and stack joystick sets after reading the material on chapter 11 and watching the learning video integrated with the module.
12.	Robot Line Follower	Training participants get to know the Line Follower Robot from its specification to its working system after reading chapter 12 material and watching the learning video integrated with the module. Training participants can program and stack the Robot Line Follower after reading chapter 12 material and watching the learning video integrated with the module.
13.	Robot Avoider	Training participants get to know the Avoider Robot from its specifications to its work system after reading the material on chapter 13 and watching the learning video integrated with the module. Training attendees can program and stack Avoiders after reading material in chapter 13, and watch learning videos integrated into the modules.

b. Design Stater Kit

The starter kit has components for robotic practice support, as well as learning modules that have been integrated with video learning. The design of the top cover, right and left sides, front and back of the box starter kit using Adobe Illustrator software, and to make the mockup using the pacdora website, at this stage is the image or design for the starter kit later what it will look like on the display part of the packaging. The starter kit uses a cardboard box for several reasons, the first is flexible because the cardboard can be shaped according to the size, adjusted to the needs for example the shape of the commons, the dimensions of the components and also how many components, besides this carton box can be youngly designed such as the cover, product information sticker, because of its flexible nature, the next is quite economical because the carton box is cheaper than some other packaging. Display of the packaging and information on the components that will be included in the starter kit are shown in Figure 2.

Fig. 2. Starter kit packaging design

4.3 Development

In the third phase of this is the development phase, which is in the process of creating the learning media in the form of a Starter kit and Video Learning Module, after being made also in this phase there is an evaluation of the media that has been made before taking data.

At this stage, make a starter kit with the module-making phase first, then assemble the components, test the grid, and finish. Robotic training design qualifications refer to starter kit learning media qualifications, video learning qualifications, and learning materials. Next, the media that has been created is evaluated by experts. The starter kit evaluation results showed that the starter kit media is in the category "Very Worth" with an average score of 40.7 and a range of x>33; in other words, the starter kit media can be used in robotic training, below is the process of calculation using the formula of Mardapi.

Table 5 Evaluation Instrument Output Data Media Starter kit

No.	Aspect	No Questionnaire	Max Score	Evaluator			Total Score
				Teacher 1	*Teacher 2*	*Lecturer*	
1.	Content Quality	1	4	3	4	4	11
		2	4	4	4	4	12
		3	4	4	3	3	10
		4	4	4	3	4	11
2.	Technical Quality	5	4	4	4	4	12
		6	4	4	4	3	11
		7	4	4	3	4	11
		8	4	3	3	4	10
		9	4	4	3	4	11
3.	Instructional Quality	10	4	4	3	4	11
		11	4	4	4	4	12
	Score of Answers Evaluator			42	38	42	
	Score of Answers						122
	Average Score						40,7

Calculation:

a. Average

$$x = \frac{\sum x\ (Answer\ Score)}{n}$$

$$x = \frac{122}{3} = 40{,}7$$

b. Maximum Ideal Score = $\sum number\ of\ queries\ x\ Max\ Score$

Maximum Ideal Score= 11 x 4

= 44

c. Minimum ideal score = $\sum number\ of\ queries\ x\ Min\ Score$

Minimum ideal score = 11 x 1=11

d. $\bar{x}$ Average Instrument Total Score

$\bar{x}$ = $\frac{1}{2}$ (Score Max. Ideal + Score Min Ideal)

= $\frac{1}{2}$ (44 + 11)

= 27,5

e. SBx = Default scores for all respondent

SBx = $\frac{1}{6}$ (Score Max Ideal – Score Min Ideal)

$$SBx = \frac{1}{6}(44 - 11) = 5{,}5$$

Table 6. Convert score media evaluation results starter kit

Score	Range Score	Category
$x \geq \bar{x} + 1.SBx$	$x \geq 33$	Very Worth It
$\bar{x} + SBx > x > \bar{x}$	$33 > x > 27{,}5$	Worthy
$\bar{x} > x \geq \bar{x} - 1.SBx$	$27{,}5 > x \geq 22$	Unworthy
$x < \bar{x}$- 1.SBx	$x < 22$	Very unworthy

The calculation results showed that the average score is 40.7, the ideal maximum score is 44, and the outstanding minimum score is 11. The moderate average of the overall score is 27.5, with the default scoring score is 5.5. Then, the score achievement can be measured through the table above, and a very qualifying result for the media stater kit can be obtained.

Fig. 3. Media validation process

4.4 Implementation

Students of Vocational Education Electrical Engineering Untirta and students of SMKN 1 Cilegon major Mechatronics are research subjects. Stater kits are then prepared for use in research. The event lasted from October 28th to November 15th. The researchers first explained the starter kit, the learning module, and the learning video module during the study. Subsequently, participants were given an opportunity to determine their location and estimate their time. Depending on the needs of the participants, the training venues vary. For training, like programming, laptop, etc.

4.5 Evaluation

At this stage, a project-based robotic training process based on arduino uno R3 was evaluated by the respondents.

Table 7. User response result data

No.	Respondent's Name	Respondent Answer Score
1.	JH	62
2.	ABM	64
3.	IKDA	57
4.	MANB	68
5.	GN	60
6.	FF	68

No.	Respondent's Name	Respondent Answer Score
7.	DW	62
8.	S	64
9.	ACD	58
10.	GAF	53
11.	AF	57
12.	RKTA	57
13.	ABPR	62
14.	SS	57
15.	HM	55
16.	ASN	64
17.	DS	51
18.	MSA	63
19.	LW	64
Score of Answers		1.146
Average Score		60,3

Calculation using the formula of Mardapi:

a. Average

$$x = \frac{\sum x\ (Answer\ Score)}{n}$$

$$x = \frac{1146}{19} = 60{,}3$$

b. Maximum Ideal Score = $\sum number\ of\ queries\ x\ Max\ Score$

Maximum Ideal Score= 17 x 4 = 68

c. Minimum ideal score = $\sum number\ of\ queries\ x\ Min\ Score$

Minimum ideal score = 17 x 1= 17

d. $\bar{x}$ Average Instrument Total Score

$\bar{x}$ = $\frac{1}{2}$ (Score Max. Ideal + Score Min Ideal)

= $\frac{1}{2}$ (68 + 17) = 42,5

e. SBx = Default scores for all respondent

SBx = $\frac{1}{6}$ (Score Max Ideal – Score Min Ideal)

SBx = $\frac{1}{6}$ (44 - 11) = 8,5

Fig. 4. Data retrieval process

The maximum ideal score is 68, the outstanding minimum score is 17, and the average overall score is 42.5, with the default scoring score being 8.5. The result of the score acquisition can be measured through the table below.

Table 8 Convert score results evaluation results user response

Score	Range Score	Category
$x \geq \bar{x} + 1.SBx$	$x \geq 51$	Very Worth It
$\bar{x} + SBx > x > \bar{x}$	$51 > x > 42{,}5$	Worthy
$\bar{x} > x \geq \bar{x} - 1.SBx$	$42{,}5 > x \geq 34$	Unworthy
$x < \bar{x}$- 1.SBx	$x < 34$	Very unworthy

Based on the above data, it is known that the average rating of the nineteen respondents is 60,3, with a range of x>51. The Arduino Uno R3 Project-based Robotic Training Design containing a learning media Starter kit, Learning Video Module, and Learning Materials belongs to the category “Very Worth.” In other words, this robotic training is worthy of being carried out.

The results of this study made robotic training design using the ADDIE method, starting from analysis to evaluation, the learning media results were considered to be very useful, and according to the respondents, the robotics training design was very useful.

5 Conclusion

In this study, the design of robotic training is tailored to problem analysis, and in accordance with SKKNI. In this training design there is a starter kit that becomes a learning medium, which contains components for scaling, video and also modules that become a reference for learning and replacing instructors.

Robotic training design qualifications refer to starter kit learning media qualifications, The starter kit evaluation results show that the starter kit media is in the category “Very Worthy,” with an average score of 40.7 and a range of x>33 words. Other starter kits and media can be used in robotic training.

In the assessment of respondents, it is known that the average rating of the nineteen respondents is 60,3 with a range of x > 51, showing that the Arduino Uno R3 project-based robotic training design containing the starter kit, learning video module, and learning materials belongs to the category “very worthwhile." In other words, this robotic training is worthy of being

carried out. The product produced in this research can be further developed especially in the following ways:

a) The addition of new media to support learning such as macromedia can make training more attractive and boost competence in the field of robotics.
b) Addition of new material or chapter in the learning module and video learning so that robotic competence can further improve.

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