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Research Article

EVOCE Robot: Developing Prototypes and Teaching Young Learners English Vocabulary

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This study aimed to find out the prototype of an EVOCE robot that gave impact of students' English vocabularies enhancement. In this study, the authors used two types of research design, namely, prototyping method and experiment research design. The mixed method is applied in this research qualitatively and quantitatively. Both vocabulary tests and observational methods of prototyping data collection were employed. The robot prototype used in the class as a tool to examine how was the effect of this media helped young learners in acquiring basic English vocabulary. The prototype has been through the test and the result showed that it suited with the needs for young learners. Nonprobability sampling was the technique used. A total of 40 students from two classes made up the research sample. The vocabulary score achievement pre and post test using EVOCE robot was compared with data analysis and t-test. The findings of value of t-stat > t-table at the significant level of 5% (1,679 > 1,328) meaning that the robot helped students become better acquisition in getting new vocabulary and influenced their level of vocabulary score. As the result, this research therefore has consequences for the teacher's understanding that the usage of robots can both increase students' vocabulary and also have an impact on their level of English proficiency.

1. Introduction

Early language acquisition begins with what is heard, seen, and practiced, and this influences the children's vocabulary development [1] Susanto states that more than 2,500 vocabulary words can be pronounced by youngsters between the ages of 5 and 6 due to their language development. Children as young learner as 5 or 6 years old are already able to participate in a discussion when they can talk about nouns such as things and adjectives such as beauty, feeling, speed, and different. Children are already able to hear what others are saying and participate in those conversations. Children between the ages of 5 and 6 have been known to comment on a variety of actions and events as well as what they saw [2].

Language is an aspect of society. Children can also be exposed to a language through audio-visual media [3, 4]. Children who are learning a language are not given specific instructions on how to use it; instead, they actively create and test different uses for the language that they are exposed to [5]. Through this hands-on method, the kids create a language of their own that matches the language of the adults in their environment [6]. In light of this, the young child's mind is not a blank canvas that is filled by the surrounding and children's language is not a duplicate of what they hear around them and try to emulate [7]. Although a language clearly only consists of a small number of sounds, we are able to create an absolutely endless number of utterances with just those sounds [8]. So, kids often come up with sentences that they have never heard before [9]. By the time a child enrolls in school, they have developed into proficient language users. In general, children learn words or vocabulary more quickly when supported by supporting tools, such as images, objects, and sounds [10, 11]. Early childhood is easier time to learn vocabulary because children more easily describe the words in their minds [12]. In general, what this research believe is that the learning will support children to learn by creating a meaningful atmosphere for language learning and facilitate to immediate information process [13], and exposing to real objects, which allows them visualize later, is considered as a good way to study vocabulary of a language [14]. Moreover, the way that many kids live, study, and play has already started to be impacted by artificial technology [15, 16]. All of this paves the way for a day when children grow up not just as digital natives but also as natives of artificial intelligence, who will interact with technology in fundamentally different ways than previous generations [17].

Numerous studies have demonstrated that a young child's vocabulary size is a strong indicator of success in later grades; the broader the children's vocabularies in the primary classes, the higher their academic achievement in the upper years [18]. Children learn by observation and interaction with others which frequently results in psychological and behavioral changes in them. Additionally, when the context is useful and pertinent to them, learning is better fostered [19, 20].

Based on the previous explanation, the media that will help young learners acquire words nouns or vocabulary in form of images, objects, and sounds using significant technological developments provide an opportunity for teachers to develop a variety of alternative learning media as media in the teaching and learning process [21]. Literature review of Technology Enhanced Language Learning for foreign language learning revealed that most of the related robot applications for learning English have increased in recent years, especially in English for young learners [22]. Robots have also been used in English for young learners' classes to help with vocabulary learning and production [23]. One of the benefits of robots that has long been recognized by research is that it allows children to develop sensorimotor skills through interaction with real objects [24].

2. Educational Robotics Trends

Robot is a mechanical device capable of doing human work or behaving like human [25]. Robots are designed by humans to help humans in doing work that has high accuracy, high risk, and continuous with great power [26]. Based on the control process, robots are divided into two types, namely, automatic robots and robots teleoperation robots [27].

The last ten years have seen a remarkable rise in global interest in robotics. Many people believe that robotics can provide new advantages to education at all levels [28]. Likewise expanding is the market for educational robots. Researchers and practitioners in education have praised this system for its ability to increase upper-grade students' interest in and understanding of many subjects [29].

Since then, there has been a steady increase in the use of robotic technology in public schools [30] (Neumann). The use of a variety of robot applications to engage young people in learning a variety of subjects is now a trend in educational robotics [31]. English as second or foreign language is one of the topics. Students who learn English as foreign language is the area where robot helpers have been utilized most frequently in Japan, Korea, China, and other nations seeking advancements in educational technology [32–35]. For young children, a plain computer screen devoid of social circumstances might not be as useful as a technological design that incorporates a social and interactive context. Children could acquire a language and literacy in a social and meaningful setting with a robot [36].

Recently, several business partners created a number of humanoid robots and investigated ways to use them to close the gap in education especially English for foreign language [37]. However, getting humanoid robots on the market for the general public has been significantly hampered by the expensive cost of production. Companies are vying to create more practical and cheap robots for use in classrooms as well as to create high-caliber robot apps to support English for young learners. EVOCE robot seems to open up a whole new area of possibilities for affordable, instructional robots by combining a smart phone, robot toy, and learning tool.

Robot-assisted language learning has been shown to be effective in reducing foreign language anxiety, and robot can help young learners learn English as a foreign language and improve their oral skills. Alemi et al. [22] conducted research with a robotic teaching assistant. Persian-speaking students in Iran were taught English as part of the research. A survey of the students revealed that those who learned from the robot were significantly less anxious than those who did not. While a variety of factors were thought to contribute to this reduction in anxiety, the authors claimed that intentional mistakes made by the robot were a major reason.

Thus, educational robots communicate with people in more human-like ways, such as through conversation, nonverbal clues, eye contact, and expressive expressions [38]. Back-channeling, attentive conduct, and vocal expressivity are just a few examples of the nonverbal cues that social robots use that young children are able to detect and respond to in rich ways [39].

From the studies mentioned above, the gap was difference between this study and other earlier studies that the EVOCE robot was implemented in increasing young learner students' vocabulary. The focus of the study, however, differs from the idea of the majority of the studies focused on English learning outcomes on cognitive development in English for young learners, when compared to other forms of technology [40].

Therefore, this research was conducted to examine the effect of EVOCE robot in students' vocabulary and the process of prototype design. The results of this study are expected to increase the teachers' understanding of using varieties media to increase students' development in English vocabulary.

The robot used in this paper is EVOCE robot. We say that this robot is as an interactive learning media for early childhood based on the result of pre and post test data displayed below, and this robot is utilized to develop young children's logical thinking skills. The given command buttons equipped on the robot made students try to notice, observe, and remember the steps to be made. The robot may be programmed to move forward, backward, turn left, or revolve endlessly. A prototype robot will then be created to give students and teachers an overview for educational purposes.

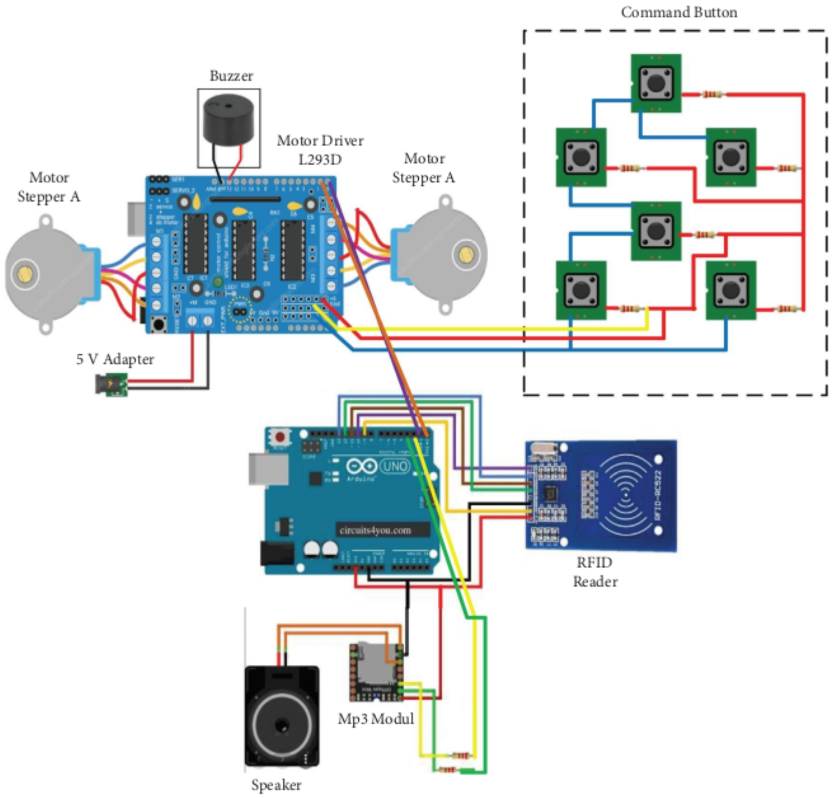

Figure 1: EVOCE robot prototype series.

3. Process of Design and Development

The research was carried out through a prototype modeling. The processes of needs analysis, design, product creation, testing, validation, and system implementation were used to build the Robot EVOCE prototype model.

3.1. Establishing Design Specifications. The robot system used in this study is composed of a number of electronic circuits that can be divided into three primary blocks, namely, input, process, and output blocks. See the illustration below for further information. See Figure 1.

There are two different forms of input media in the systems mentioned above, namely, command buttons and RFID sensors. The RFID sensor is a sensor that will eventually work to recognize or detect images on the mattress based on the ID number on the mattress, whereas the command button serves as a medium for interaction between the user and the robot.

3.1.1. Process Block. As the circuit's primary processing device or controller, the process block is made up of numerous Arduino microcontroller boards. Two Arduino microcontroller boards are employed in this study; one board processes and executes user-inputted commands, whereas the other board serves a different purpose. While the other board processes data from the RFID sensor and checks the ID number against the required sound file, the first board processes input from the RFID sensor.

3.1.2. Output Block. The output of this evoke robot system is a robot that moves from one location to another while making English-language sounds in response to the image of the mattress that is picked up by the ID number. This prototype can be used to teach English, particularly when introducing new vocabulary.

3.2. Hardware Design. The following circuits are utilized in hardware design:

3.2.1. Power Supply. This EVOCE robot runs on an 18650 3.7 volt type of lithium-ion battery. Three batteries are utilized, two of which are wired in series to act as the microcontroller's power source. While one provides power to the speakers using only pure batteries. See Figure 2.

3.2.2. Sensor. The sensor used to detect the code on the mattress is RFID type RC522 (see Figure 3). The function of the sensor is to read the ID number on the RFID sticker tag

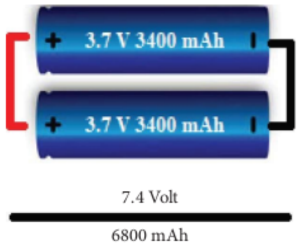

FIGURE 2: EVOCE robot power supply battery circuit.

mounted on the mat, so that the robot is able to identify the sound code that will be played according to the image on the mat.

3.2.3. Mechanical. Stepper motors are used in the robotic wheel drive system. By keeping track of the motor's steps, the usage of a stepper motor (see the Figure 4) attempts to make it easier to regulate the robot's distance traveled. A 90-degree rotation angle also makes it easier to control the robot's rotational direction.

3.2.4. Controller. As a robot controller circuit, this study used the Arduino uno r3 microcontroller board. The number of Arduino boards (see Figure 5) used is two. One Arduino board is used as a driving controller or robot mechanic, while the other is used to control the RFID sensor and sound module (see the details data in Table 1).

3.3. Software Design. Arduino IDE is software that is used to create programming sketches or in other words, Arduino IDE is a medium for programming on Arduino microcontrollers. Writing code/programs through Arduino IDE is done using C language. The program written on this Arduino device has the following functions:

(a) As a mechanical controller that drives the robot, the driver uses a mechanical stepper motor, as well as receives input from the user via the command button that has been provided. The commands on the button function to move the robot forward, backward, turn left, and turn right.

(b) The code/program written on the second Arduino microcontroller board functions to read the ID number on the mattress and then plays the mp3 file that matches the ID number obtained.

The programming step is also performed in this stage by providing the process of giving a computer (or a robot) a series of commands to make it do exactly what we want it to do. A programming language (see Figure 6) is a language that is understood by computers. It is made up of commands that can be entered into the computer. A program is made up of one or more command sequences. Computers run programs that are written in a programming language. EVOCE robot understands four different commands as follows: one that tells it to move one field forward, one that tells it to move two fields forward, and one that tells it to move three fields forward. There are four key concepts when we use EVOCE robot. First, it turns on the spot, not sideways; next, it moves in a straight line forwards and backwards; then, the more button presses you enter, the faster it moves, and last users must enter instructions precisely.

The children should be familiar with the EVOCE buttons and understand how to use them. EVOCE benefits from a mix of directed and free play time. Children may require some time to understand the clear button, move forward and backward, and turn left and right. They will also need to practice pressing the GO button once the EVOCE is ready to move. Most children benefit from being shown how to use the EVOCE. While some children will enjoy playing and figuring out how to make it work, many will become bored if EVOCE continues to do the wrong thing. The lear button is critical. Some teachers have discovered that telling some students that the clear button "helps tell EVOCE to listen to new commands" is beneficial.

Concepts commands are the fundamental actions that are preprogrammed into a coding language. EVOCE robot responds to six commands, namely, move forward, move backward, turn left, turn right, pause for 1 second, and then clear all commands. When commands are combined in a specific order, they form a program; then, the event in coding instructs your program to detect when something external occurs and to take action when it does. The only event that EVOCE robot can detect is when the "go" button is pressed. This button launches the program.

The press button starts the EVOCE robot to move while it is going through the line, and the EVOCE will pronounce the words it passes. There are three main topics to be produced by EVOCE robot while passing the mat, namely, school supplies, foods and drinks, and also clothes.

After having finished designing the EVOCE robot, the researchers continued the implementation of this robot in the classroom. The result of observing and experimenting with the robot is described in the next part.

4. Findings and Discussion

4.1. Pre-Experiment Activity. An EVOCE robot was created by the researchers. By identifying and speaking English words, this robot is utilized to develop young children's logical thinking skills. With the help of the given command buttons, the robot may be programmed to move forward, backward, turn left, or revolve endlessly. The robot's RFID sensor will be engaged when the command to move from box to box has been carried out, allowing it to read the ID number on the mat where the robot's location has stopped. Using the ID number that is read to identify the sound file, the robot will play the sound in English as shown in the illustration of the mat below.

The EVOCE robot prototype (Figure 7) is utilized as a tool for English-language acquisition when introducing vocabulary to young children, as well as for honing kids' logical thinking skills through straightforward programming. This learning model is one of the ones that can be used with STEM-based teaching strategies (science, technology, engineering, and mathematics).

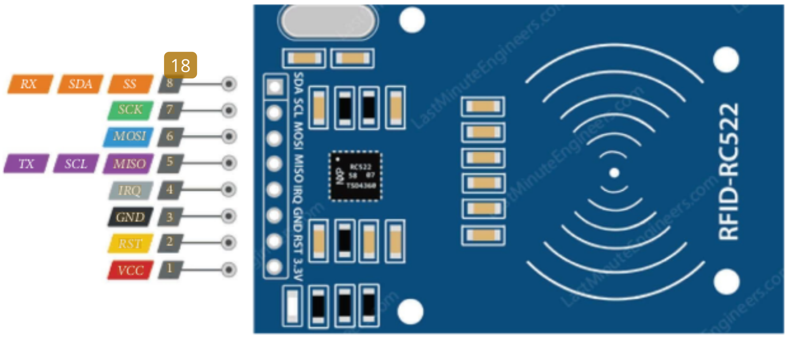

FIGURE 3: RFID RC522.

FIGURE 4: Stepper motor.

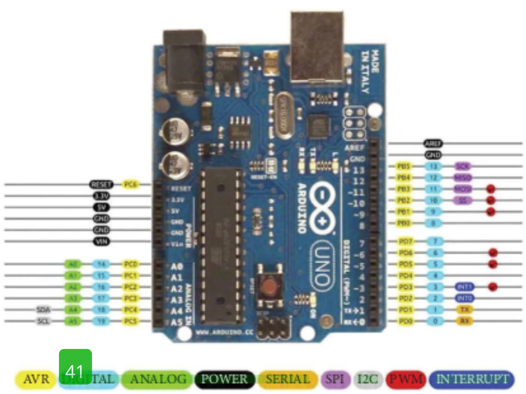

FIGURE 5: Arduino uno r3 board.

4.1.1. EVOCE Robot Prototype Test Result. Numerous tests were conducted, including tests of the sound module, the RFID sensor module, and the robot driving system. Testing of the entire system is done to see how well the robot prototype system has operated. The user can configure the robot's movement by pressing the forward (blue button up), backward (blue button down), turn left (white button next to left), and turn right buttons once the robot's memory has been cleared by pressing the clear button (red button) at the beginning of use (right white button). The next stage is to hit the green button to start the robot after entering a series of orders using the button. The robot will move in accordance with the preprogrammed command, and when it stops, it will scan the ID number on the mat directly underneath it in order to recognize it and play the appropriate sound file. The results of the EVOCE robot function test (Table 2) are shown as follows:

The percentage of error value can be determined from the validation functionality results in Table 3 using the following formula:

$$\text{Error\%} = \frac{9-9}{9}\, x\, 100\% = 0\,\%. \tag{1}$$

Thus, based on the results of the functional validation test, it can be categorized as functioning very well. In the left and right turn test, the robot does not have a precision of 900 rotation directions, but when moving forward or backward, the robot prototype does not come out of the mattress box measuring 20×20 cm, so it is concluded that the robot moves to the left or right with a level of precision that can still be tolerated.

4.1.2. Testing of the Robot Driving System. To make sure that the robot drive can be programmed and can operate in accordance with the program sequence that has been fed into the EEPROM memory, this drive system is tested (see Table 3). See the video of driving system test. A testing table for the EVOCE robotic driving system is shown as follows:

Based on the test results, it can be said that the robot prototype propulsion system is already capable of performing the determined functions and commands. The left motor propels the vehicle forward, while the right motor rotates in the opposite direction (CCW). When moving backwards, the left motor turns in a counterclockwise (CCW) direction, while the right motor turns in a clockwise direction (CW). Following that, the left and right motors rotate clockwise (CW) to move the prototype to the right and vice versa to move the prototype in the opposite direction (CCW).

4.1.3. Sound Module Testing. The sound module (DF Player Mini) is put to the test to determine the voltage that is generated when the DF Player Mini module plays the recorded sound on the SD memory card. See the video of sound module test. The voltage will be measured using a digital multitester. Table 4 shows the outcomes and test photos.

Table 1: Types of PINs and functions on Arduino uno R3.

PIN category	PIN name	Details
Strength	Vin, 5 V, 3.3 V, GND	Vin: input voltage to Arduino when using an external power source 5 V: the power supply used for the microcontroller board 3.3 V: voltage generated by the on-board regulator GND: ground
Reset	Reset	Resetting the microcontroller
Analog PIN	A10–A5	To provide an analog input of about 0–5 V
Input/output PIN	PIN digital 0–13	Adaptable to input and output PIN
PWM	3, 5, 6, 9, 11	To receive or transmit TTL serial data
SPI	10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK)	As an interrupt trigger
LED	13	Supplying 8-bit PWM output
TWI	A4 (9SDA), A5 (SCA)	As SPI communication
AREF	AREF	To turn on the LED light

Source: https://www.arduino.cc.

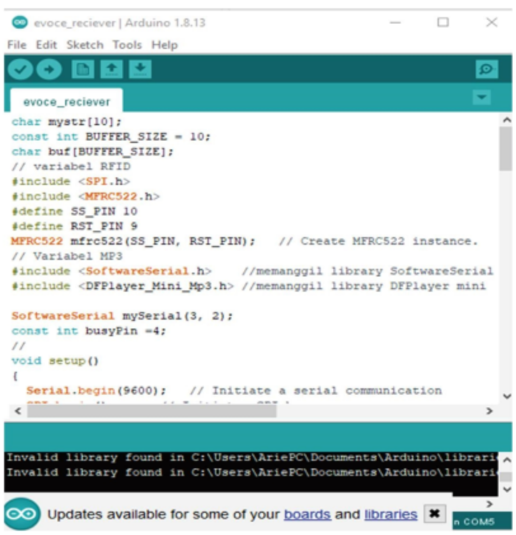

Figure 6: Arduino IDE EVOCE receiver.

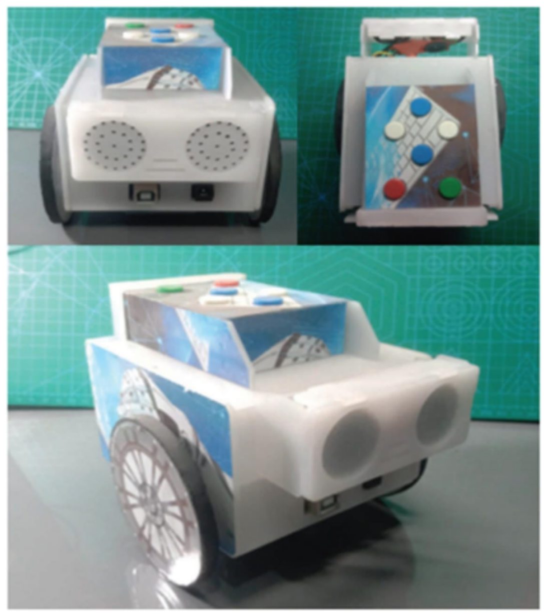

Figure 7: Exhibition of the EVOCE robotics prototype.

The result of sound module testing has shown that mini DF player module's test results show that a voltage of 0.694 volts is produced when an mp3 file is played on the device when it is used to play a mini DF player.

4.1.4. RC522 RFID Sensor Testing. RFID Card testing is carried out using a frequency emission sensor of electromagnetic waves issued from the RFID reader RC522. This experiment uses 2 RFID cards, one of which can be accepted and rejected through RFID card detection by verifying the ID number that has been obtained, one of which will be entered into the source code program of the entire tool. Testing the RFID card is by sticking one of the cards closer to the RFID reader rc522 at a distance of 1–3 cm. The first test that must be done is to read the detection of the RFID card received by the RFID Reader. The way to get the ID number stored from the RFID card is to run the program on the Arduino IDE through the sample provided from the RFID card sales source who has provided a special library for testing the RFID card. The pins connected to Arduino and loaded in the Arduino IDE program have been set, that is, pin D10 as SS (Software Serial) and pin D9 as Reset pin. This is done to test whether the RFID card can be detected on the serial monitor by attaching the RFID card to the RFID Reader. After obtaining the ID number on the card, the next step is to make a comparison logic by comparing the ID number obtained with the ID number data in the program. If the ID number is found, the sound of the mp3 file will be played through the DFPlayer mini module, while if the ID number is not found, the system does not respond. The following Table 5 is a RFID test samples:

Table 2: Types of PINs and functions on arduino uno R3.

No.	Requirements tested test items	Test results Yes	No
Arduino 1	Is EEPROM memory capable of holding commands?	✓	
Arduino 1	When the green button is pressed, can the data stored in the EEPROM memory be retrieved?	✓	
Arduino 1	When the red button is pressed, is the data in the EEPROM memory deleted?	✓	
Arduino 2	Is the ID number detectable by the sensor module?	✓	
Arduino 2	Are the speakers capable of playing mp3 audio files?	✓	
Left stepper	Does the stepper motor rotate in the predetermined direction?	✓	
Right stepper	Does the stepper motor rotate in the predetermined direction?	✓	
Move forward and backward	Can the prototype robot go forward and backward?	✓	
Turn left and right	Can the prototype robot rotate 90 degrees left or right?	✓	

Table 3: Test of the robot drive system.

No	Order of command	Motor movement Left motor	Right motor	Robot prototype motion
1		CW	CCW	Move forward
2		CCW	CW	Moving backward
3		CW	CW	Move around to the right
4		CCW	CCW	Move around to the left

Table 4: Sound module testing (mini DF player).

Trial No.	Mini DF player module status	Length of time	Voltage (V)	Description
1	Receiving no responses	0	0.088	Sound DF player off
2	Getting response	5	0.694	Sound DF player on

Pretest was held in this session. Two groups (control and experiment class) were having vocabulary test. Both classes got basic vocabulary test.

4.2. Experiment Activity. Over a two-week period, there were four sessions of the experiment. The experiment group members got the opportunity to operate the EVOCE robot. About 20 of the 40 students present in each session operated with robots. The topics given varied from school supplies, foods and drinks, and clothes. The robot was available for all of the students to be operated and inquire about words' meanings. This was only applicable to the experiment class, while the control class was not using the robots.

4.3. Postexperiment Activity. The post-test was given to the students after the experiment finished. On the same day, both group (control and experiment class) completed the vocabulary test. Overall, the methodical process took a month to complete and covered all of the key steps.

4.4. Data Analysis. The SPSS version 23 program was used to analyze the quantitative data. The outcomes of the post-test were compared to those of the pretest using the independent samples *t*-test. The data from the observational method were examined to produce descriptive statistics which have been described above. Regarding the research questions, the results are presented as follows:

Table 5: Testing the RC522 RFID RFID sensor.

No.	Id number	Condition	Action
1	24 BD 27 CD	Found	Sound file 0001.mp3 played
2	81 B4 E0 26	Found	Sound file 0002.mp3 played
3	E5 D2 98 EE	Not found	No respond

Table 6 shows that for control class, there was no significant difference between the average post-test results (74.25) and the average pretest results (70.00). It signifies that the control class has a 4.25 point difference between pretest and post-test that is slightly different.

The data in Table 7 showed that in the average results of pretest and post-test in the experimental class, there was a difference, where the post-test results were higher (78.85) than the pretest results (71.50). It means that there was a slightly significant effect of using the EVOCE robot in the experiment class.

Table 8 result showed that based on $df = 20 - 1 = 19$ at a significant level of 5%, a *t*-table of 1,729 is obtained and at

Table 6: Paired samples statistics control class.

		Mean	N	Std. deviation	Std. error mean
Pair 1	Pretest control	70.0000	20	7.94719	1.77705
	Post-test control	74.2500	20	7.12206	1.59254

Table 7: Paired samples statistics experiment class.

		Mean	N	Std. deviation	Std. error mean
Pair 1	Pretest experiment	71.5000	20	8.59927	1.92285
	Post-test experiment	78.8500	20	8.43723	1.88662

Table 8: Paired samples T-test.

		Paired differences							
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Post-test control-post-test experiment	−4.60000	12.24917	2.73900	−10.33279	1.13279	−1.679	19	0.109

a significant level of 1%, a t_{tabel} of 1.328 is obtained. A t_{count} of 1.679 means that it is greater than t_{tabel} at a significant level of 5%, while at a significantly smaller level of 1% ($1.729 < 1.679 > 1.328$), H0 is rejected and Ha is accepted. In other words, there is a significant difference between student learning outcomes between the pre-test in the experimental class and the post-test in the experimental class at a significance level of 5%.

From the significance value (2-tailed) between the pretest and post-test values, a value of 0.109 is obtained, which means it is greater than 0.05. It can be concluded that there is no difference in the results between the control class post-test and the experimental class post-test.

5. Discussion

There were two main objectives to be explained in this part. The first was about the prototype EVOCE microcontroller circuit, which is powered by two separate sections. The Arduino Uno R3 series board was the microcontroller board that was utilized as a robot control system [41].

The second objective was to find out whether the EVOCE robot contributed to the impact on the students' score on vocabulary. The current study did not uncover a significant difference between the two groups' performances in vocabulary learning. Nevertheless, both groups significantly increased their vocabulary, which is in line with other research done by Schodde et al. [42]. The result of students score in learning vocabulary did not show the effect significantly, which is somewhat better in terms of the mean scores, which is different from the findings of Alemi et al. [43] who used the same robot design process, and next was the impact of this robot towards the achievement of students' vocabulary. The research result showed that concepts commands are the fundamental actions that are preprogrammed into a coding language. The EVOCE robot responds to six commands as given as follows: move forward, move backward, turn left, turn right, pause for 1 second, and then clear all commands. When commands are combined in a specific order, they form a program; then, the event in coding instructs your program to detect when something external occurs and to take action when it does. The only event that the EVOCE robot can detect is when the "go" button is pressed. This button launches the program. These steps made students more creative and innovative, and the robots were used as interactive learning media for early childhood [17, 24].

There are three main topics to be produced by the EVOCE robot while passing the mat, namely, school supplies, foods and drinks, and also clothes [44]. One piece is especially utilized to deliver voltage to the speakers, while the driving motor and robot function with a group of school-aged participants. There could be a number of causes for this result.

First factor was that the students in this study were younger than those in other studies, which is a difference in the achievement result score [41, 45]. This finding of the EVOCE robot contributed to a slight effect on students' achievement.

Second factor was that the function and the program of the EVOCE robot prototype sometimes did not work properly, so some students were difficult to catch the sound of vocabulary produced by the robot. This result correlated with [6, 38] (Levine) findings that product of robot needed more overview of the additional program, and thus the operation runs smoothly.

Third factor was that this EVOCE robot was quite new introduced to the students. Thus, the acceptance and the training took a little bit longer and made the students frustrated getting the new English vocabulary, although robot was attracting them to play and study but the psychological factor affected their mood in learning foreign language [2].

6. Conclusion

Based on the results of the study, it can be concluded that the goal of this study was to ascertain whether using robots may affect young language learners' vocabulary acquisition and the process toward using such technology. Data that were both quantitative and qualitative were thus gathered. Since participants in both groups achieved comparable progress in vocabulary learning, the quantitative data analysis did not identify statistically. This result may be explained by a number of important factors including the novelty of the technology used, the participants' limited prior interaction with the robot, issues with voice recognition and speech rate that were reported, students' poor listening skills, individual differences, and reported technical difficulties. Different reactions to the technology could have been caused by these variables. Additional research is required to further understand how many circumstances affect the results of this experiment because this study was limited to one. It is hoped that in the next stage of research, the robotic microcontroller circuit can be made to be a minimum size so that the size of the robot can be reduced again. In addition, the robot drive system should use a gearbox so that it can increase the RPM of the stepper motor. It is hoped that the smaller robot design and the increased movement speed of the robot can make this EVOCE robot prototype a superior product in learning vocabulary recognition in early childhood.

Data Availability

The data used to support the findings of this study are available at https://link.springer.com/article/10.1007/s12369-015-0286-y, https://www.semanticscholar.org/paper/Using-Games-as-a-Tool-in-Teaching-Vocabulary-to-Bakhsh/b940275fe6ffcb19dfced1364abc38df9a4068fe, https://www.cambridge.org/core/journals/language-teaching/article/abs/language-learning-in-mindbodyworld-a-sociocognitive-approach-to-second-language-acquisition/F8F022E944921041EE09639D69302694, https://onlinelibrary.wiley.com/doi/abs/10.1111/jcal.12469, https://www.mdpi.com/2227-7102/12/7/437, https://www.sciencedirect.com/science/article/abs/pii/S0360131518302033, https://link.springer.com/article/10.1007/s11528-021-00637-1, https://www.mdpi.com/2227-7102/11/11/709/html, https://dl.acm.org/doi/10.1145/3025453.3025735, https://archive.org/details/robotbuildersbon00mcco/page/n7/mode/2up, https://www.lltjournal.org/item/948/https://onlinelibrary.wiley.com/doi/abs/10.1111/modl.12691https://dl.acm.org/doi/10.1145/2909824.3020245, https://academic.oup.com/eltj/article-abstract/63/2/173/441531?redirectedFrom=fulltext, https://onlinelibrary.wiley.com/doi/10.1002/cae.20347, https://www.frontiersin.org/articles/10.3389/fnhum.2017.00295/full, https://www.odbms.org/2017/08/artificial-intelligence-the-next-digital-frontier-mckinsey-global-institute-study/, https://www.frontiersin.org/articles/10.3389/frobt.2017.00047/full, https://ioinformatics.org/journal/v11_2017_143_150.pdf, https://link.springer.com/article/10.1007/s12369-014-0277-4, https://onlinelibrary.wiley.com/toc/15404781/2020/104/S1https://www.sciencedirect.com/science/article/abs/pii/S0346251X21002451https://www.goodreads.com/book/show/9901946-practical-english-language-teachinghttps://www.je-lks.org/ojs/index.php/Je-LKS_EN/article/view/1135005https://www.routledge.com/Coding-as-a-Playground-Programming-and-Computational-Thinking-in-the-Early/Bers/p/book/9780367900502. https://link.springer.com/article/10.1007/s10643-019-00997-7https://dl.acm.org/doi/10.1145/3345506, https://doi.org/10.1145/3290605.3300677https://dl.acm.org/doi/10.1145/3290605.3300677, https://link.springer.com/chapter/10.1007/978-3-031-15273-3_17https://dl.acm.org/doi/10.1145/3078072.3084330, https://www.tandfonline.com/doi/abs/10.1080/10494820.2020.1780269?journalCode=nile20, https://www.frontiersin.org/articles/10.3389/fnhum.2017.00073/full, https://www.sciencedirect.com/science/article/abs/pii/S2212868916300538, https://onlinelibrary.wiley.com/doi/abs/10.1002/cae.22321, https://www.academia.edu/48863431/Distance_Education_in_China_Issue_5_2021_Table_of_Contents_Abstracts_of_Major_Articles_in_English, and https://www.tandfonline.com/doi/abs/10.1080/10494820.2020.1786409?journalCode=nile20.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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