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ORIGINAL ARTICLE

Examining Teachers' Self-Efficacy Perceptions in the Use of Educational Robots According to Different Variables

Mustafa Kemal AVCI[1*], Necmi ESGI[2]

[1]M.A. Mustafa Kemal AVCI, Teacher, Erbaa Alparslan Mid.school. Tokat Türkiye
ORCID: 0000-0002-1955-2572

[2]Prof. Dr. Necmi ESGI, Tokat Gaziosmanpaşa University, Faculty of Education, Tokat, Turkiye
ORCID: 0000-0001-5655-7965

Ethical Statement
Provide how you addressed ethical issues. *For example, consent forms were distributed, and ethical board approval was granted (No: 12/34, Institution).*

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The study has no conflict of interest to close.

ABSTRACT

The aim of this study is to examine the perceptions of educational robot use self – efficacy of teachers participating in the in – service robotic coding training of the Ministry of National Education (MNE) General Directorate of Teacher Training according to gender, age group, education level, branch, type of institution served, seniority, time spent after receiving training, training method, having worked before and after the course, having a suitable environment for practice, number of training received, type of training, encouragement of education administrators, having a colleague working at their school. The sample of this research, which uses a quantitative scanning model, consist of 245 teachers working in Tokat Province at the beginning of 2022 – 2023 academic year and participated in courses on in – service robotic coding. In the research, '' The Self – Efficacy Perception Scale For The Use Of In – Class Educational Robots For Teachers'' developed by Şahin and Korkmaz (2020) was used which one factor and consisting of 49 items. SPSS (25.0) statistical software was used in the analysis of the data. P<.05 was accepted as the level of significance, and Man – Whitney U test and Kruskal – Wallis H test were used in the relationship of variables. As a result of the research, it was determined that the teachers participating in the MNE in-service training did not consider themselves partially sufficient to use educational robots in the class. In addition, it has been determined that the ex – officio intake of teachers in – service training doesn't change their self – efficacy, but at the end of the trainings, there is a significant difference in the self-efficacy perceptions of teachers who have a practice environment.

Keywords: Self – Efficacy, In – Service Education, Educational Robot, Coding Training

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***Corresponding Author:** Prof. Dr. Necmi ESGI, Tokat Gaziosmanpaşa University, Faculty of Education, Educational Sciences, Instructional Technology
Email: necmi.esgi@gop.edu.tr

INTRODUCTION

Countries set future-oriented goals in educational programs to prepare their citizens for rapidly changing social structures and work environments (Özdemir, 2015). Ensuring the production of high-value-added products, which has become more important than the workforce, holds a significant place in countries' economic systems (İnan, 2019, p. 95). Individuals with 21st-century skills will possess the competencies to cope with changing work and living conditions (Cengiz, 2019). Computational thinking skills are a key aspect of 21st-century skills. These skills comprise high-level cognitive skills such as algorithmic thinking, problem solving, collaborative working, abstraction, decomposition, and coding. The skill of computational thinking can be summarized as the adaptation of the processes experienced by a software engineer while developing software in real life (Çetin & Toluk Uçar, 2018, pp. 54-70). In order to equip individuals with computational thinking skills, coding, and software education are being integrated into educational programs. Beginning in 2014, England has started coding and programming education in primary and secondary schools, emphasizing the necessity of including software development, mobile application, and animation preparation in the curriculum alongside teaching office programs in computer technology classes; 16 European countries made coding education mandatory at the primary and secondary education levels in 2014; the United States viewed coding education as akin to foreign language education and incorporated it into the curriculum; while China decided in 2017 to include course contents consisting of coding and artificial intelligence activities in its teaching programs (Şimşek, 2018, pp. 40-56).

In Turkey, the Ministry of National Education (MEB) set concrete targets for digital skills in the 2023 Vision Document published in 2017. Training sessions for teachers, students, administrators, and the public are among the goals outlined in the 2023 Vision Document, including preparing digital teaching materials and the inclusion of necessary achievements into course curricula (Ministry of National Education [MEB], 2018). In line with these targets, the curriculum for information technologies and software courses for the 2018-2019 academic year was updated to include coding, robotic coding, and 3D design achievements. It has been decided that information technologies and software courses will be mandatory in grades five and six and offered as elective courses for two hours weekly in grades seven and eight. At the primary school level, information technology courses can be incorporated into free activity hours; the necessary textbooks have been made digitally accessible for teachers and students at each grade level via the Education Information Network (EBA). Accordingly, in primary schools, information technology and software courses can be optionally taught by classroom teachers.

Coding is expressing the operations to be performed on a computer system in a way that can be understood by the system (Erten, 2019). This form of expression is referred to as programming language. Programming languages consist of textual forms comprising specific writing rules, English words, and abbreviations. Developers' preferred programming languages are Python, C#, Java, C++, and PHP (https://bilginc.com). Konan (2020) stated that learning these languages is often tedious and challenging for children at the primary education level and those new to coding. Code is essential for developing technological designs and preparing software using information technologies. Visual coding software, referred to as block-based coding, is used instead of text-based programming, which is often perceived as tedious and difficult to learn, to identify and nurture the interests of children who have aptitude and interest in this area in primary education (Çatlak, Tekdal, and Baz, 2015).Code.org, Scratch, Mblock, MIT App Inventor, and Blockly Games are commonly used block-based coding software (Sayın, 2020).

Coding, whether text-based or block-based, involves abstract thinking, developing solutions to encountered problems, and finding the most suitable solution through trial and error (Bala, 2019). To make this process easier for elementary school students, robotic products are used in coding education to provide a concrete experience (Acar, 2021). The physical manifestation of the effects of the command and the group of commands used during coding on a robot serves to motivate and explain coding concepts for children. The most widely used robotic products in coding education include Arduino, mBot, Lego Wedo, Lego EV3, Vex, Raspberry Pi, and micro: bit (Eğin & Arıkan, 2020). These educational robots can be utilized in coding training or other lesson activities. Educational robots can help create teaching materials and facilitate motivating student lesson activities. It is believed that teachers' ability to use educational robotic products will directly influence the learning process in the classroom. Teachers who consider themselves sufficiently competent in using educational robots and have high self-efficacy will likely overcome potential challenges in implementing robotic applications in education and effectively plan various engaging activities.

Arseven (2016) stated that the level of self-efficacy perception can be measured through three indicators: level, strength, and generalizability. The researcher defines self-efficacy perception as self-efficacy strength, measured by a person's belief in their capability to perform a task. Additionally, the research findings identified four main factors affecting self-efficacy perception: the individual's directly experienced experiences, indirectly experienced experiences, verbal persuasion, and psychological state.

Teachers working in public schools under the Ministry of National Education participate in local or central training programs organized by professionals in their field, either mandatorily or based on their request. These trainings are in-service activities organized by the General Directorate of Teacher Training (ÖYGM). Training provided to individuals appointed to specific positions in institutions to teach them knowledge and developments related to their work is called in-service training (Taymaz, 1981, p.36). Training can be conducted in person, online synchronously, or asynchronously. In 2018, the ÖYGM updated the education plan. From that year onwards, in-service training courses on coding, robotic coding, software development, and 3D design have been opened for teacher participation. It is thought that monitoring and researching the development of professional competence and self-efficacy of the teachers who participated in these trainings will lay the groundwork for making the use of educational robots in learning environments more efficient.

Academic studies conducted in the last five years were examined through searches made using keywords like "Robotic coding education," "In-service robotic coding education," "robotic coding self-efficacy," and "Use of educational robots" in the Higher Education Institution (YÖK) thesis center and Google Scholar. The examined studies showed that robotic coding education significantly created differences in attitudes and perceptions in many areas (Korucu & Taşdöndüren, 2019; Şahin, Korkmaz, Çakır, and Erdoğmuş, 2019; Sayın, 2020) and positively impacted academic success (Talan, 2020). Additionally, studies indicated that teacher candidates possessed superficial knowledge (Göncü, Çetin, and Top, 2018); studies on teacher opinions revealed that it positively influenced their professional development (Sayın, 2020). Furthermore, teachers have expressed the desire for an increase in the number of in-service training courses and the provision of workshop opportunities (Aksu, 2019); they noted that it would be beneficial to provide training that includes practical activities (Erdem, 2019; Sönmez & Şahinkayası, 2021). Again, these studies found that teachers with high self-efficacy were more effective in teaching the subject (Karacaoğlu, 2008).

Although there exists a study (Acar, 2021) demonstrating that educational robot applications positively influence teachers' information technology self-efficacy, no study has been found that examines the perceptions of robotic coding self-efficacy in the context of in-service training based on variables such as subject, education name, or school type. Gökbulut (2020) pointed out that the General Directorate of Teacher Training (ÖYGM) updated its plans in 2018 to standardize coding education for teachers and noted that 2,204 teachers took the “Basic Coding and Technology Use Course” within a year; he emphasized the need to examine whether particularly classroom teachers.

METHOD

This research utilizes a descriptive survey model from a quantitative research design. The descriptive survey model is a framework that can be used to reveal the state of the relationship between two or more variables, to comment on the strength of that relationship if it exists, and to make predictions (Tekbıyık, 2019, p.164). The reason for using this model in the study is to examine the differentiation of the self-efficacy of a specific group of participants who have attended a particular training according to various variables. Information was requested from teachers participating in in-service robotic coding courses across the province to determine the size of the research population.

Procedure

In the study, the "Self-Efficacy Perception Scale for the Use of Educational Robots in the Classroom for Teachers," developed by Şahin and Korkmaz (2020), was used as a data collection tool. A personal information form with expert opinions was also used to determine the participants' demographic information. The scale used in the research was developed by Şahin and Korkmaz (2020) to measure the self-efficacy perceptions of teachers at all levels regarding the use of educational robots in teaching environments.

Data Analyses

The scale consists of a single factor and 49 items in a 5-point Likert type (“1-I definitely cannot, 2-I cannot partially, 3-I am undecided, 4-I can partially, 5-I definitely can”). When examining the scale development study, it was observed that the factor loadings of the scale were analyzed using the Varimax orthogonal rotation technique and that the scale had a single-factor structure; a unidimensional factor analysis was conducted, and no items with a loading lower than .40 were removed from the scale, as the construct and content validity of the scale were not compromised. An item-total correlation analysis was carried out to determine the levels at which the items served their purpose, showing that items with values between .704 and .954 were positively and significantly related to the overall scale. The Cronbach alpha value of the scale was found to be .759. The values of Cronbach Alpha calculated through confirmatory and exploratory factor analysis studies indicated that the Teacher Self-efficacy Perception Scale regarding the Use of Educational Robotics in Classroom Settings is a reliable and valid data collection tool. The data collection process was conducted in October and November of 2022. A personal information form and the “Teacher Self-efficacy Perception Scale regarding the Use of Educational Robotics in Classroom Settings” were prepared using the Google Forms web 2.0 tool. Information was gathered regarding the schools where the teachers serve, and the scale was sent to teachers in the accessible population via WhatsApp from the school, project, and work groups. Additionally, the scale was made printable in Microsoft Excel and was applied in printed form to teachers who could be reached face-to-face. It was observed that filling out the scale took between five to eight minutes.

RESULTS AND DISCUSSION

The data analysis regarding "the examination of the self-efficacy perceptions of teachers who received in-service robotics coding training in using educational robots in the classroom" used IBM SPSS 25.0 statistical software. The "Kolmogorov-Smirnov normality test" was conducted to determine whether the data showed a normal distribution. This test indicates whether the research data exhibits a normal distribution at a significance level 0.05 (Can, 2022, p.90). The results of this test are presented in Table 1.

Table 1. Kolmogorov-Smirnov Test Result

	Kolmogorov-Smirnov[a]		
	Statistic	**df**	**Sig.**
Competence	.109	245	.000

According to Table 1, the Kolmogorov-Smirnov test was found to be p < .05. As a result of the evaluation, it was revealed that the participants' perceptions of self-efficacy did not show a normal distribution. The effects of variables such as gender, the method of receiving training, work status after training, encouragement from the educational administrator, and the presence of colleagues working at the school on teachers' self-efficacy perceptions regarding the use of educational robots in the classroom were analyzed using the "Mann-Whitney U Test." The "Mann-Whitney U Test" was developed to test whether there is a significant difference between two variables in datasets that do not show a normal distribution (Can, 2022, p. 128). To compare teachers' self-efficacy perceptions regarding the use of educational robots in the classroom based on the variables of seniority, age, subject area, institution type, teaching method, and reason for participating in training, the "Kruskal-Wallis H Test" was conducted. The "Kruskal-Wallis H Test" is a test that reveals whether there are significant differences between two variables with more than two subgroups in datasets that do not show a normal distribution (Can, 2022, p. 160). In cases where a significant difference arises among the variables, the "Mann-Whitney U Test" was applied to determine the direction of the difference.

The "Mann-Whitney U Test" was conducted to determine whether the participants' level of self-efficacy significantly differed based on their gender. The test results are presented in Table 2.

Table 2. Results of the Mann-Whitney U Test on the Perception of Self-Efficacy Based on Gender Variable

Group	N	Avr. Order	Sum Order	U	p
Woman	113	115,69	13073,00	6632,000	.135
Man	132	129,26	17062,00		

According to Table 2, no significant difference was observed between the self-efficacy perception levels of women (Median = 2.71) and men (Median = 3.04) (U = 6632, p > .05). Therefore, there is no significant difference in self-efficacy perception based on the gender variable.

The "Kruskal-Wallis H Test" was conducted to determine whether the participating teachers' self-efficacy varies by age group. The results are presented in Table 3.

Table 3. Kruskal-Wallis H Test Results for Self-Efficacy Perception Based on Age Group Sub-groups

Group	N	Avr. Order	Sd	H	X2	p
30 years of age and below	23	104,07	3	4,734	1,98	.192
31-40 age	142	131,05				
41-50 age	77	113,98				
50 and above	3	118,67				

The results of the tests related to the self-efficacy levels of the four age groups presented in Table 3 indicate that there are no significant differences in the participants' self-efficacy levels based on their age groups (H= 4.734, p>.05). Accordingly, it can be concluded that self-efficacy perception does not significantly vary according to the age variable.

The "Mann-Whitney U Test" was conducted to determine whether the educational status of the study participants differentiates their self-efficacy perception levels. The test results are provided in Table 4.

Table 4. Mann-Whitney U Test Results for the Educational Status Variable Regarding Self-Efficacy Perception

Group	N	Avr. Order	Sum Order	U	p
Lisans	201	124,73	25071,00	4074,000	.414
Lisansüstü	44	115,09	5064,00		

According to Table 4, the results of the test conducted to determine whether there is a significant difference in self-efficacy perceptions based on educational status among groups composed of 201 participants with undergraduate degrees and 44 with graduate degrees showed no significant difference between the self-efficacy perception levels of those with undergraduate education (Median = 2.92) and those with graduate education (Median = 2.33) (U = 4074, p > .05). Therefore, it can be stated that the variable of educational status does not create a significant difference in self-efficacy perceptions.

The "Kruskal-Wallis H Test" was conducted to determine whether self-efficacy varies according to the subjects of the teachers participating in the research. The results are presented in Table 5.

Table 5. Results of the Kruskal-Wallis H Test on the Self-Efficacy Perceptions of Subgroups Based on the Subject Variable

Group	N	Avr. Order	Sd	H	X^2	p	Meaningful Difference
P.E	8	106,94	12	61,106	44,094	.000	Religious Studies – Computer Sci. (p=0.001) Turkish- Computer Sci. (p=.000) English – Computer Sci. (p=.006) Literature – Computer Sci. (p=.022) Social Studies– Computer Sci. (p=.046) Technology &Design– Computer Sci.(p=.011) Natural Sciences– Computer Sci. (p=.012) Primary School -Computer Sci. (p=.000) Kindergarten-Computer Sci.(p=.002) Maths-Computer Sci.(p=.026)
Computer Sci.	49	187,7					
Religious Studies	8	69,44					
Literature	6	76,42					
Natural Sciences	16	110,66					
English	7	74,00					
Maths	19	118,95					
Kindergarten	30	118,23					
Primary School	56	114,91					
Social Studies	8	94,94					
Technology &Design	14	106,00					
Turkish	11	72,00					
Others	13	115,54					

The results of the test on the self-efficacy levels of the 13 branch groups given in Table 5 showed that there was a Meaningful Difference in the self-efficacy levels of the branches of the participants (H= 61,106, p<.05). The branches with less than (n=5) participants (visual arts (n=4), biology (n=1), physics (n=1), chemistry (n=1), music (n=1), vocational courses (n=3) and guidance (n=2) were grouped under “Other” branch and the analysis was made accordingly. Pairwise comparisons were made to determine which branches of Meaningful Differentiality occurred. As a result of the “Mann-Whitney U” tests, religious culture and ethics branch and Computer Sci, Turkish branch and Computer Sci. branch, English branch and Computer Sci. branch, literature branch and Computer Sci. branch, social studies branch and Computer Sci. branch, technology and design branch and Computer Sci. branch, science branch and Computer Sci. branch, classroom teaching branch and Computer Sci. branch, preschool teaching branch and Computer Sci. branch, mathematics branch and Computer Sci. branch. When looking at the average rankings of the branches, it has been observed that all differences are on the side of the Information Technology branch. To indicate the significance of the meaningful difference, the Chi-Square value was divided by one less than the total sample size, resulting in an effect size of Eta squared ($\eta 2 = 0.18$). Accordingly, it can be said that the branches of the participants differentiate their self-efficacy perceptions, but this effect is negligible. To determine whether the self-efficacy of the teachers participating in the research varies according to the type of institution they work at, the "Kruskal-Wallis H Test" was conducted, and the results are presented in Table 6.

Table 6. Results of the Kruskal-Wallis H Test for Self-Efficacy Perception by Subgroups of the School Type Variable

Group	N	Avr. Order	Sd	H	X^2	p
Kindergarten	21	112,5				
Primary School	63	113,51				
Middle school	127	123,31				
High-school	30	149,23	5	5,717	5,63	.335
Guidance Research Centre	1	116,00				
Special Education and Application School	3	122,83				

The results of the tests regarding the self-efficacy levels of teachers working in six different types of schools, as given in Table 6, indicate that there are no significant differences in the self-efficacy levels based on the types of schools the participants work in (H= 5.717, p>.05). Accordingly, it can be concluded that the variable of the type of school does not create a significant difference in the perception of self-efficacy.

The "Kruskal-Wallis H Test" was conducted to determine whether self-efficacy varies according to the seniority of the participating teachers. The results are presented in Table 7.

Table 7. Kruskal-Wallis H Test Results for the Perception of Self-Efficacy by Subgroups of the Seniority Variable

Group	N	Avr. Order	Sd	H	X^2	p
0-10 years	66	124,69				
11-20 years	143	126,22	3	3,559	2,95	.313
21-30 years	35	109,49				
31 and more	1	24				

The test results regarding the groups' levels of self-efficacy, according to their time spent in the profession, as shown in Table 7, indicate that there is no meaningful difference in self-efficacy levels based on participants' seniority (H= 3.559, p>.05). Accordingly, it can be assessed that the seniority variable does not create a significant difference in the perception of self-efficacy.

A "Kruskal-Wallis H Test" was conducted to determine whether the periods following the participants' courses led to variations in their self-efficacy. The results are presented in Table 8.

Table 8. Results of the Kruskal-Wallis H Test on the Subgroups of the Variable for the Time Passed After the Course Concerning Self-Efficacy Perception

Group	N	Avr. Order	Sd	H	X^2	p
Less than 6 months	55	128,43				
6- 12 months	46	125,46	2	.612	.952	.736
More than 12 months	144	120,14				

The test results of the time elapsed after taking the Course on the self-efficacy levels of the Groups given in Table 8 showed that the time elapsed after taking the Course did not create a Meaningful Difference in the self-efficacy levels of the participants (H= .612, p>.05). Accordingly, it can be concluded that the variable of time elapsed after taking the Course does not create a significant difference on self-efficacy perception.

The "Kruskal-Wallis H Test" was conducted to determine whether participants' self-efficacy varies according to their methods of participation in robotic coding courses. The results are presented in Table 9.

Table 9. Results of the Kruskal-Wallis H Test on the Subgroups of the Course's Teaching Method Variable Regarding Self-Efficacy Perception

Group	N	Avr. Order	Sd	H	X^2	p	Meaningful Difference
Remote	51	106,62					
Face to Face	128	109,22	2	27,953	19,002	.000	Remote – Remote + Face to Face (p=.000) Face to Face- Remote + Face to Face (p=.000)
Remote + Face to Face	66	162,38					

The results of the test on the self-efficacy levels of the participants who received training in Remote, face-to-face, or both methods given in Table 9 showed that the Course methods in which the participants received training created a Meaningful Difference in their self-efficacy levels (H= 27,953, p<.05). Pairwise comparisons were made to determine in which training method the Meaningful Differentiality occurred. “Mann-Whitney U” tests revealed a Meaningful Difference between Remote and both Remote and Face to Face, Face to Face and both Remote and Face to Face. When the ranking averages of the course methods were analyzed, it was seen that all differences were significant in the direction of those who received Remote and face-to-face training. The effect size was found as Eta squared (η2=0.08) by dividing the Chi-Square number by one minus the total sample size to indicate the significance of the Meaningful Difference. According to this, it can be said that the Course method differentiates the self-efficacy perceptions of the participants, but the effect of this is low.

The "Mann-Whitney U Test" was conducted to determine whether the participants' prior experience in robotic coding differentiated their levels of self-efficacy. The test results are presented in Table 10.

Table 10. Mann-Whitney U Test Results Regarding the Self-Efficacy Perception of the Variable of Having Worked Before Taking the Course

Group	N	Avr. Order	Sum Order	U	p
Yes	85	148,80	12648,00	4607,000	.000
No	160	109,29	17487,00		

According to Table 10, the results of the test conducted to reveal whether there was a significant difference between the self-efficacy perceptions of the Groups consisting of 85 participants who had done research/study on robotic coding before the Courses they took and 160 participants who had not done research/study, a Meaningful Difference was observed between the self-efficacy perception levels of those who had done study before the Course (Median =3,61) and those who had not done study before the Course (Median =2,41) (U=4607, p<.05). When the ranking averages of those who did and did not study were compared (148,80>109,29), it was seen that the self-efficacy of those who did study was higher than those who did not study. Cohen's d coefficient was calculated to determine the effect size, and it was found to be (d=0.56). According to this, it can be said that the variable of having done a study before the Course creates a significant difference in self-efficacy perception, and the effect of this effect is moderate.

The "Mann-Whitney U Test" was conducted to determine the effect of the participants' status of conducting research/work in robotic coding after taking the course on their perceived self-efficacy levels. The test results are presented in Table 11.

Table 11. Results of the Mann-Whitney U Test on the Perceived Self-Efficacy Related to the Variable of Having Conducted Work After the Course

Group	N	Avr. Order	Sum Order	U	p
Yes	88	157,13	13827,00	3905,000	.000
No	157	103,87	16308,00		

According to Table 11, to determine whether there is a significant difference in the self-efficacy perceptions of the groups consisting of 88 participants who have conducted research/work on robotic coding after taking courses and 157 participants who did not conduct research/work, the results of the test showed that there was a significant difference between the self-efficacy perception levels of those who worked after the course (Median = 3.61) and those who did not work after the course (Median = 2.10) (U=3905, p 103.87), it was noted that the self-efficacy levels of those who worked were higher than those who did not work. The "Cohen d" coefficient was calculated and found to be (d=0.79) to determine the effect size. Accordingly, it can be said that the variable of having worked after the course created a significant difference in self-efficacy perception and that this difference has a significant effect.

The "Mann-Whitney U Test" was conducted to determine whether the participants' self-efficacy levels significantly differed regarding having the necessary qualifications to work in school settings. The test results are presented in Table 12.

Table 12. Results of the Mann-Whitney U Test on the Variable of Having an Appropriate Environment to Work and Its Impact on Self-Efficacy Perception

Group	N	Avr. Order	Sum Order	U	p
Yes	81	150,96	12228,00	4377,000	.000
No	164	109,19	17907,00		

According to Table 12, a significant difference was found in the perceptions of self-efficacy regarding the suitability of the work environment between those who indicated a suitable school environment (81 participants) and those who indicated that there was not (164 participants). The self-efficacy perception levels of those with a suitable environment (Median=3.69) were significantly higher compared to those without a suitable environment (Median=2.41) (U=4377, p109.19), it was observed that the self-efficacy of those with a suitable environment was higher than those without. The “Cohen d” coefficient was calculated and found to be (d=0.60) to determine the effect size. This indicates that the variable of having a suitable school environment for working creates a significant difference in perceptions of self-efficacy, and this difference has a moderate effect size.

To determine whether the number of courses participants took on robotic coding varied with their self-efficacy perceptions, a “Kruskal-Wallis H Test” was conducted, and the results are included in Table 13.

Table 13. Results of the Kruskal-Wallis H Test for the Subgroups of the Number of Courses Taken Related to Perceptions of Self-Efficacy

Group	N	Avr. Order	Sd	H	X^2	p	Meaningful Difference
1 Course	126	101,6					1 Course – 2-4 Course (p=.001)
2-4 Courses	99	135,67	2	35,390	20,842	.000	1 Course – 5 Courses and more (p=.000)
5 Courses and more	20	195,13					2-4 Courses – 5 Courses and more (p=.002)

According to Table 13, test results related to the self-efficacy levels of participants attending courses show that the number of courses taken by the participants led to a significant difference in their self-efficacy levels (H = 35.390, $p < .05$). To determine the direction of the significant difference, binary comparisons were made. The "Mann-Whitney U" tests showed a significant difference between participants taking one course and those taking 2-4 courses, between participants taking one course and those taking five or more courses, and between participants taking 2-4 courses and those taking five or more courses. When comparing rank averages, it was determined that the order of self-efficacy perception levels was from highest to lowest: 5 or more courses, 2-4 courses, and one course. The effect size Eta squared ($\eta 2 = 0.09$) was calculated by dividing the Chi-Square number by one less than the total sample size to indicate the importance of the significant difference. Thus, it can be said that the number of courses participants took differentiated their self-efficacy perceptions, but the effect was low.

A “Mann-Whitney U Test” was conducted to examine the differentiation of participants' self-efficacy levels based on the methods of receiving in-service training, and the test results are presented in Table 14.

Table 14. Results of the Mann-Whitney U Test for the Variable of Method of Receiving Training on Self-Efficacy Perception

Group	N	Avr. Order	Sum Order	U	p
At my request	222	127,85	28383,50	1475,500	.001
Compulsory	23	76,15	1751,50		

In order to reveal whether there is a significant difference in the self-efficacy perceptions of 222 participants who reported voluntarily attending in-service training and 23 participants who reported attending mandatorily, a test was conducted. The findings indicated a significant difference between the self-efficacy perception levels of those who voluntarily participated in the courses (Median = 3.01) and those without suitable conditions (Median = 1.69) (U = 1475.500, $p < .05$). When comparing the ranking averages of those who participated in the courses voluntarily or mandatorily (127.85 > 76.15), it was observed that the self-efficacy perception levels of those who attended the courses voluntarily were higher than those who attended mandatorily. The "Cohen's d" coefficient was calculated and found to be (d = 0.74) to determine the effect size. Accordingly, it can be stated that the method of attending the course created a significant difference in self-efficacy perception, and the impact of this difference is substantial.

A “Mann-Whitney U Test” was conducted to identify whether participants' self-efficacy levels varied based on the encouragement and suggestions from education administrators. The test results are presented in Table 15.

Table 15. Mann-Whitney U Test Results for the Variable of the Presence of Encouragement from Education

Administrators to Participate in Courses regarding Self-Efficacy Perception.

Group	N	Avr. Order	Sum Order	U	p
Yes	87	125,92	10955,00	6619,00	.632
No	158	121,39	19180,00		

In Table 15, a test was conducted to determine whether there is a significant difference between the self-efficacy perceptions of 87 participants who expressed that the educational administrator provided encouragement and 158 participants who stated otherwise. The findings showed no significant difference in the self-efficacy perception levels of the encouraged participants (Median = 2.98) and the discouraged participants (Median = 2.87) ($U = 6619$, $p > .05$). Therefore, it can be said that the presence of encouragement/suggestions from the educational administrator does not create a significant difference in self-efficacy perception.

A "Mann-Whitney U Test" was conducted to investigate whether participants' self-efficacy levels varied with the presence of a colleague working on robotic coding in their school. The test results are presented in Table 16.

Table 16. Results of the Mann-Whitney U Test Regarding the Variable of Having a Colleague Working on Robotic Coding at School on Self-Efficacy Perception

Group	N	Avr. Order	Sum Order	U	p
Yes	105	125,70	13198,50	7066,500	.605
No	140	120,98	16936,50		

Table 16 in the findings of the test conducted reveals whether there is a significant difference between the self-efficacy perceptions of 105 participants who stated that they had a colleague working on robotic coding at their school and 140 participants who stated that they did not have a colleague working at their school, no Meaningful Difference was observed between the self-efficacy perception levels of those who had a colleague working (Median =3.00) and the self-efficacy perception levels of those who did not have a colleague working (Median =2.87) ($U=7066.500$, $p>.05$).

This study examines teachers' self-efficacy levels who have completed at least one in-service robotic coding course provided by the Ministry of National Education (MEB) in the Tokat province regarding using educational robots in the classroom from various perspectives. These perspectives include gender, age group, educational background, subject area, type of institution they work for, seniority, time elapsed since their last training, teaching methods of the course(s) taken, previous experience related to the subject before the course(s), experience related to the subject after the course(s), having a suitable home/school environment to work in, number of in-service training sessions received, method of receiving in-service training, encouragement and recommendations from educational administrators, and the presence of other colleagues working in their school.

The self-efficacy perception scores of 245 teachers who participated in the study were found to be between the "I can somewhat do it" and "I am uncertain" levels, leaning closer to the uncertain level ($\bar{x} = 2.76$). The average scores of items 1, 2, 3, 4, 5, 10, and 11, which measure the level of recognition and general knowledge of educational robots, were above 3.00, while the averages of the other items were below 3.00. In this case, it could be interpreted that teachers generally recognize educational robots and see themselves as somewhat competent regarding the features and functions of the essential components of educational robots but do not feel sufficient in more advanced skills such as coding robots, using various sensors, and solving potential problems. It may be considered that teachers' low self-efficacy perception levels regarding using educational robots are due to their lack of application of what they learned after the training and the inadequacy of the methods and duration.

According to the findings of this study, which examined the self-efficacies of 113 female and 132 male teachers, no significant difference was found between the self-efficacies of women and men; however, the average self-efficacy of male candidates was higher according to rank averages. Thus, it can be said that both female and male teachers consider themselves equally competent in using educational robots in classroom activities. This research is consistent with the study conducted by Erdemir Yılmaz (2021), which examined the self-efficacies of science teachers in engineering education. In contrast to this research, however, it was stated that female teachers were more knowledgeable about the characteristics of engineers than male teachers. Hsu, Purzer, and Cardella (2011) also researched classroom teachers' familiarity with design, engineering, and technology, which is consistent with this research. Ekici (2009), in his study on the self-efficacy levels of biology teachers regarding laboratory usage, found that women significantly differed from men, contrary to this research. It is thought that differences in the relationship between self-efficacy level and gender may be influenced by participants' preparedness levels and gender roles in social life.

It was observed that the age of teachers did not significantly differentiate their self-efficacy perceptions regarding the use of educational robots in the classroom. In contrast, the self-efficacy level was higher among participants aged 31-40 compared to other age groups. This situation can mean that teachers participate in professional development activities regardless of age when they wish to contribute to their professional growth; hence, age does not influence the development of their self-efficacy perceptions. Burmabıyık (2014) obtained parallel results in their studies examining teachers' self-efficacy regarding technological pedagogical content knowledge. Aksoy and Diken (2009) conducted a study with guidance counselors and found results consistent with this research, stating that professional experience is unrelated to the teacher's age. Contrary to this research, Bal and Karademir (2013) stated that a significant negative correlation exists between age and self-efficacy in the dimensions of technology-related self-efficacy. Although educational robotics applications have entered the classroom as a new technology, self-efficacy levels show significant variation according to age, which has emerged as an unexpected situation.

In a sample of 201 undergraduate and 44 graduate-level participants, no significant difference was found among self-efficacy levels; however, it was observed that the average self-efficacy rankings of undergraduate participants were higher than those of graduate participants. The lower perceived self-efficacy levels of graduate participants in using educational robotics could be interpreted as a sign that graduate education does not enhance the perception of self-efficacy in this area. In the literature, Kılınç Bozkurt (2019) found compatibility in his study on the self-efficacy of social studies teachers regarding character education; similarly, Avcı (2011) conducted a related study in a different province, which aligns with this research. However, in contrast to this research, Vatansever, Bayraktar, and Çelik (2021) expressed that factors like student participation, teaching strategies, and overall self-efficacy levels are differentiated by educational status, with this difference favoring associate degree graduates.

In a study involving teachers from 19 different fields, the perceived self-efficacy levels of teachers in the "Information Technologies" field showed significant differences compared to teachers in the "Religious Culture and Moral Knowledge," "English," "Literature," "Social Studies," "Technology and Design," "Science," "Preschool Education," "Classroom Teaching," "Mathematics," and "Turkish" fields. It can be said that the interests and undergraduate education of information technology teachers lead to higher self-efficacy in using educational robotics. Kaymak and Titrek (2021) revealed that classroom teachers exhibited significant differences in technology adaptation self-efficacy compared to social studies teachers. Vatansever Bayraktar and Çelik (2021) indicated that the self-efficacy levels in classroom management skills of visual arts teachers were lower than those of teachers in all other fields. In contrast to this research, Tekin and Özaydınlık (2019) stated that perceived self-efficacy levels in computer use are not affected by disciplines but that the high self-efficacy scores of classroom teachers could be attributed to their greater involvement in lesson planning, activity planning, etc. Aslan and Kalkan (2018) found that teachers' self-efficacy did not vary by discipline, while Burmabıyık (2014) showed that technological pedagogical content knowledge self-efficacy levels did not differ by discipline.

The type of school the teachers work at does not seem to differentiate their perceived self-efficacy in using educational robotics; however, based on average scores, it can be said that high school teachers see themselves as more competent in using educational robotics. In their studies, Erdemir Yılmaz (2021) and Coşkun (2010) claimed that the measured perceptions of self-efficacy were independent of school type, aligning with this research. Contrary to this research, Kaymak and Titrek (2021) indicated that teachers' self-efficacy in using and facilitating technology showed a significant difference favoring elementary school teachers over high school teachers. Aslan and Kalkan (2018), who measured teachers'perceived self-efficacy regarding student participation, found that high school teachers feel sufficiently competent to create a significant difference compared to middle school teachers.

Among the participants, 85% had less than 20 years of seniority, and in this study group, the self-efficacy levels in using educational robotics did not vary by seniority. Therefore, it can be assumed that the in-service training teachers receive reflects their professional development regardless of their seniority. Koç (2013) found in his study that the seniority of classroom teachers has a distinguishable effect on their self-efficacy in classroom management skills. In a study by Kartal, Temelli, and Şahin (2018), which examined the perceived self-efficacy levels of mathematics teachers concerning gender, it was stated that seniority had a differentiating effect on self-efficacy levels. Ekici (2009) has identified that the laboratory management self-efficacy of biology teachers significantly differs according to their seniority. Şahin et al. (2019), in their study examining the perceived self-efficacy of information technology teachers regarding coding, reported similarly to this research that seniority does not differentiate teachers' self-efficacy levels.

Before conducting research, there was no significant difference in the perception of self-efficacy levels among those who received in-service training one or two terms ago or in earlier periods. The average rankings of these groups were also found to be very close to each other. Based on these data, it can be interpreted that teachers who received in-service training related to educational robots did not forget the skills they acquired over time and that the skills developed were permanent due to the practice-oriented content of the training.

This study, which included teachers who received MEB in-service training either face-to-face, remotely, or through both methods, observed that the educational methods created significant differences in their perception of self-efficacy. While there was no significant difference between those trained solely through remote education and those who received only face-to-face education, it was understood that there was a significant difference in the self-efficacy perception levels of teachers who received training through both remote and face-to-face methods. In light of this data, it is thought that teachers interested in educational robots who value their professional development may have participated in training through both methods, strengthening their belief in their ability to perform high-level skills. It can be inferred that the combination of the ability to progress at one's own pace in the theoretical information acquired through remote education and the practical advantages of face-to-face education would raise the self-efficacy perception levels for both types of training.

One of the factors affecting the perception of self-efficacy is the experiences and learnings acquired through a person's past experiences. Within the scope of the research, participants were asked whether they had engaged in studies related to educational robots before and after receiving in-service training, and significant differences in self-efficacy perceptions were found between those who engaged in such studies before and after training and those who did not. It can be suggested that teachers who conducted studies related to educational robots were able to participate in in-service training in order to address their knowledge gaps, find answers to their questions, or obtain certification, leading to significant differences in their self-efficacy levels.

The number of participants engaged in work before or after training and those with a suitable school environment were similar. A suitable environment would allow teachers to work independently and attempt to apply what they learned within a limited timeframe to a broader one. This situation may have significantly differentiated their self-efficacy perceptions. Research data also indicate that having a suitable home/school environment significantly impacts teachers' self-efficacy perception levels.

The research across the province found that five courses were offered under in-service training. It was concluded that the number of courses attended by participating teachers created significant differences in their self-efficacy perception levels. Teachers who attended only one course had the lowest self-efficacy perceptions. In comparison, those attending two to four courses showed significant differences in self-efficacy levels compared to those attending only one course, and those attending five or more courses showed significant differences in self-efficacy levels compared to those attending only one course and those attending two to four courses. Based on this data, it can be expressed that the repetition of acquired knowledge and re-learning through various activities positively influences self-efficacy perception levels.

A significant difference was found in the self-efficacy perception levels between those who participated in in-service training involuntarily and those who did so willingly. Participating in training under duress does not contribute to teachers' professional development and, consequently, to learning environments. In certain situations, educational administrators can register teachers for training against their will. The research shows that this condition does not positively affect teachers or students.

Literature has indicated the effectiveness of verbal persuasion in developing self-efficacy beliefs. According to the research findings, no significant differences were identified in self-efficacy perception levels between those who were encouraged by educational administrators to participate in robotic coding in-service training and those who were not. From this perspective, it can be considered that teachers participated in training because they wanted to and that external encouragement did not significantly affect their self-efficacy.

According to self-efficacy theory, individuals form their self-efficacy perceptions by observing successful and unsuccessful people around them. There was no significant difference in the self-efficacy perception levels of participants in this study based on whether or not they had colleagues working on educational robots in their school. This situation, which contradicts Bandura's statement, may be attributed to teacher communication issues or the weak transfer of experience between teachers.

CONCLUSION AND RECOMMENDATIONS

This study concluded that teachers participating in in-service training provided by the Ministry of National Education (MEB) feel sufficient for essential topics regarding using educational robots in the classroom but not for intermediate and advanced topics. Although information technology teachers exhibit high self-efficacy regarding the use of educational robots, it has been found that teachers from other fields do not possess the same level of self-efficacy perception. It has been observed that forcing teachers to participate in in-service training, whether willingly or unwillingly, does not alter their self-efficacy. Retaking courses on the same topic through online and face-to-face training significantly impacts their self-efficacy. Teachers in practical environments at the end of training have greater confidence in using educational robots.

It has been determined that participants who study educational robots before or after the course have a high perception of self-efficacy. It has been found that the self-efficacy perceptions of male and female teachers participating in in-service training; teachers from different age groups; teachers pursuing postgraduate education and those with bachelor's degrees; the encouragement of educational administrators in attending courses; the type of institutions where teachers work; the duration of service; the time elapsed after receiving in-service training; and having colleagues working at the same school do not differentiate teachers' self-efficacy perceptions. Based on the research results, the following recommendations can be made for other researchers and educational administrators: A broader study should be conducted to obtain more generalizable findings. The effects of different in-service training courses on self-efficacy perceptions should be investigated. Some portions of remote in-service training should be live and interactive with question-and-answer sessions. Material support should be provided for workshops in provinces and districts for face-to-face in-service training. Teachers should be offered the opportunity to work within the school after training, and a suitable environment should be provided for this purpose. Mandatory participation in in-service training should be ended.

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REFERENCES

Acar, B. (2021). Eğitsel robot eğitiminin öğretmenlerin kabul, hizmet içi eğitime dönük tutum ve bt kullanımı öz-yeterliliklerine etkisi. Yayımlanmamış yüksek lisans tezi, Amasya Üniversitesi Fen Bilimler Enstitüsü, Amasya.

Aksu, F. N. (2019). Computer Sci. öğretmenleri gözünden robotik kodlama ve robotik yarışmaları. Yayımlanmamış yüksek lisans tezi, Balıkesir Üniversitesi Fen Bilimleri Enstitüsü, Balıkesir.

Arseven, A. (2016). Öz yeterlilik: bir kavram analizi. Journal of Turkish Studies, 11(18), 63–80.

Bala, R. B. (2019). 6.sınıf öğrencilerine programlama dili öğretilirken kullanılan scratch programının öğrencilerin problem çözme becerilerine ve tutumlarına etkisi. Yayımlanmamış yüksek lisans tezi, Necmettin Erbakan Üniversitesi Eğitim Bilimleri Enstitüsü, Konya.

Burmabıyık, Ö. (2014). Öğretmenlerin teknolojik pedagojik içerik bilgilerine yönelik öz-yeterlilik algılarının çeşitli değişkenler açısından incelenmesi (yalova ili örneği). Yayımlanmamış yüksek lisans tezi, Sakarya Üniversitesi Eğitim Bilimleri Enstitüsü, Sakarya.

Can, A. (2022). Spss ile bilimsel araştırma sürecinde nicel veri analizi (10. baskı). Ankara: Pegem Akademi.

Çatlak, Ş., Tekdal, M. ve Baz, F. Ç. (2015). Scratch yazılımı ile programlama öğretiminin durumu: bir doküman inceleme çalışması. Journal of Instructional Technologies ve Teacher Education, 4(3), 13–25.

Cengiz, A. S. (2019). Endüstri 4.0 sürecinin eğitim sistemine yansımaları; Türkiye örneği. Yayımlanmamış yüksek lisans tezi, Nevşehir Hacı Bektaş Veli Üniversitesi Sosyal Bilimler Enstitüsü, Nevşehir.

Çetin, İ. ve Toluk Uçar, Z. (2018). Bilgi işlemsel düşünme tanımı ve kapsamı. Y. Gülbahar (Ed.), Bilgi işlemsel düşünmeden programlamaya (3. baskı) içinde (s. 41–74). Ankara: Pegem Akademi.

Coşkun, M. K. (2010). Din kültürü ve ahlak bilgisi öğretmenlerinin özyeterlik algılarının çeşitli değişkenler açısından incelenmesi. Sosyal Bilimler Araştırmaları Dergisi, 1(1), 95–109.

Ekici, G. (2009). Biyoloji öğretmenlerinin laboratuar kullanımı öz-yeterlik algılarının incelenmesi. Ahi Evran Üniversitesi Eğitim Fakültesi Dergisi, 10(3), 25–35.

Erdem, A. (2019). Bilim ve sanat merkezi öğretmenlerinin robotik eğitimi : Süleymanpaşa / Tekirdağ örneği. Journal of Education and Training Studies, 7(7), 50–61.

Erdemir Yılmaz, D. (2021). Fen bilimleri öğretmenlerinin mühendislik öğretimi özyeterliliklerinin farklı değişkenler açısından incelenmesi. Yayımlanmamış yüksek lisans tezi, Giresun Üniversitesi Fen Bilimleri Enstitüsü, Giresun.

Erten, E. (2019). Kodlama ve robotik üzerine bir durum çalışması. Yayımlanmamış yüksek lisans tezi, Balıkesir Üniversitesi Eğitim Bilimleri Enstitüsü, Balıkesir.

Gökbulut, B. (2020, Aralık). Robotik Kodlama Hizmetiçi Eğitimleri. 4. Uluslararası Eğitim ve Değerler Sempozyumu'nda sunuldu, İstanbul.

Göncü, A., Çetin, İ. ve Top, E. (2018). Öğretmen adaylarının kodlama eğitimine yönelik görüşleri: Bir durum çalışması. Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 1(48), 85–110.

İnan, K. (2019). Bilgi toplumuna geçerken teknolojik iş(lev)sizlik. İstanbul: İletişim Yayınları.

Karacaoğlu, Ö. C. (2008). Öğretmenlerin yeterlilik algıları. Yüzüncü Yıl Üniversitesi, Eğitim Fakültesi Dergisi, 5(1), 70–97.

Kartal, O. Y., Temelli, D. ve Şahin, Ç. (2018). Ortaokul matematik öğretmenlerinin Computer Sci. öz-yeterlik düzeylerinin cinsiyet değişkenine göre incelenmesi. Kuramsal Eğitimbilim Dergisi, 11(4), 922–943.

Kaymak, E. ve Titrek, O. (2021). Öğretmenlerin teknolojiye uyumuna yönelik öz-yeterlilik düzeyinin incelenmesi. Sakarya

Üniversitesi Eğitim Fakültesi Dergisi, 21(2), 104–134.

Konan, F. (2020). Programlama öğretimine yönelik bir içerik analizi. Yayımlanmamış yüksek lisans tezi, Erzincan Binali Yıldırım Üniversitesi Fen Bilimleri Enstitüsü, Erzincan.

Korucu, A. T. ve Taşdöndüren, T. (2019). Ortaokul öğrencilerinin blok temelli programlamaya ilişkin öz- yeterlik algılarının ve robotiğe yönelik tutumlarının incelenmesi. Ahmet Keleşoğlu Eğitim Fakültesi Dergisi, 1(1), 44–58.

Şahin, H., Korkmaz, Ö., Çakir, R. ve Erdoğmuş, F. U. (2019). Computer Sci. öğretmenlerinin kodlamaya dönük tutumları , öz -yeterlilikleri ve kodlama öğretimi için kullandıkları yöntemler. Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 38(2), 1–16.

Şahin, H. ve Korkmaz, Ö. (2020) Öğretmenlere yönelik sınıf içi eğitsel robot kullanımına dönük özyeterlik algısı ölçeği geliştirme çalışması. Ahi Bilge Eğitim Dergisi, (ABED) 1(1).1-14.

Sayın, Z. (2020). Öğretmenlerin kodlama eğitimin de eğilimleri nin belirlenmesi. Journal of Instructional Technologies ve Teacher Education, 9(1), 52–64.

Şimşek, İ. (2018). Dünyada programlama öğretimi. Y. Gülbahar ve H. Karal (Ed.), Kuramdan uygulamaya programlama öğretimi (1. baskı) içinde (s. 38-65). Ankara: Pegem Akademi.

Sönmez, S. ve Şahinkayası, Y. (2021). Öğretmenlerin maker hareketi ve robotik kodlama faaliyetlerinde yaşadığı sorunlar ve önerileri. Mustafa Kemal Üniversitesi Eğitim Fakültesi Dergisi, 5(7), 277–296.

Talan, T. (2020). Eğitsel robotik uygulamaları üzerine yapılan çalışmaların incelenmesi. Journal of Education for Life, 34(2), 503–522.

Taymaz, H. (1981). Hizmet İçi Eğitim Kavramlar İlkeler Yöntemler. Ankara: Sevinç Matbaası.

Tekbıyık, A. (2019). İlişkisel tarama yöntemi. H. Özmen ve O. Karamustafaoğlu (Ed.), Eğitimde Araştırma Yöntemleri (1. baskı) içinde (s. 164–178). Ankara: Pegem Akademi

Tekin, O. ve Özaydınlık, K. (2019). Remote eğitim yöntemi kullanılan hizmet içi eğitim programının öğretmenlerin bilgisayar özyeterlilik algıları ve bilgisayara yönelik tutumlarına etkisi. Akdeniz Üniversitesi Eğitim Fakültesi Dergisi, 2(1), 19–35.

Vatansever Bayraktar, H. ve Çelik, O. (2021). Öğretmenlerin öz yeterlilikleri ile sınıf yönetimi becerileri arasındaki ilişkinin incelenmesi. İZÜ Eğitim Dergisi, 3(6), 98–127.

Classroom Educational Robot Self-Efficacy Perception Scale *(Şahin and Korkmaz(2020)	**Strongly Disagree**	**Disagr ee**	**Neutr al**	**Agr ee**	**Strongly Agree**
I can identify the parts of an educational robot.					
I can assemble separated educational robot parts to design a robot.					
I can identify sensors.					
I know how to connect sensors to an educational robot.					
I know how to attach wheels to an educational robot.					
I know how to attach sensors to an educational robot.					
I can design an educational robot to address a given problem.					
I can assemble the robot parts as I wish while designing an educational robot.					
I can disassemble and redesign an educational robot if I encounter a problem.					
I can connect a power cable to an educational robot.					
I can connect an educational robot to a computer.					
I can design an educational robot with multiple sensors simultaneously.					
I can use an ultrasonic distance sensor in my programs.					
I can use a color sensor in my programs.					
I can use a touch sensor in my programs.					
I can use a gyro sensor in my programs.					
I can use buttons in my programs.					
I can change the direction of my educational robot based on sensor data during operation.					
I can change the speed of my educational robot based on sensor data during operation.					
I can rotate my educational robot at a specific angle.					
I can make my educational robot perform tasks based on colors.					
I can design an increment counter using a button on my educational robot.					
I can install software on any educational robot.					
I can use code blocks in educational robot software.					
I can create variables while programming an educational robot.					
I can make any movement with an educational robot.					
I can adjust the speed of the motors I use.					
I can use loop commands while programming an educational robot.					
I can perform arithmetic operations while programming an educational robot.					
I can modularly organize and design a program I will write.					
I can use educational robot applications in line with my lessons.					
I can run multiple motors connected to an educational robot.					
I can ensure that the program I write produces correct results.					
I can get output from my educational robot for the program I developed.					
I can explain the steps of the project I have in mind one by one.					
I know where to create codes in the application while programming an educational robot.					
I can make as many repetitions as I want while programming an educational robot.					
I can store the data I want in memory using variables and reuse it in later stages of the program.					
I can display data on the screen using variables in my program.					
I can understand the logic of an educational robot program when I look at it.					
I can identify errors that occur during educational robot programming.					
I can fix errors that occur during educational robot programming.					
I can recode long and complex sections to make the program clearer.					
I can solve problems in different ways while programming an educational robot.					
I conduct the necessary research to solve problems encountered while designing an educational robot.					
I can make changes to my program afterward.					
I can rearrange the process order to solve a problem in an educational robot software.					
I can rearrange the process order to solve a problem in my educational robot software.					