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An evaluation of the 10th grade robotic coding curriculum (2020) within a participant oriented curriculum evaluation approach

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Highlights

- The objective of this study was to evaluate the robotic coding curriculum that is currently being implemented in vocational and technical Anatolian high schools.
- The discrepancies between the official curriculum of the robotic coding course and the curriculum as it is actually taught were investigated.
- The robotic coding curriculum was evaluated by all relevant stakeholders, including teachers, students and school administrators.

Article Info: Research Article

Keywords: *Participant-oriented curriculum evaluation, Robotic coding, Curriculum, Vocational and technical secondary education.*

Abstract

The aim of this study is to evaluate the 10th grade robotics coding curriculum (2020) with a participant-oriented program evaluation approach. The research was designed with the convergent mixed methods design. This design is the most well-known mixed research design, whereby both qualitative and quantitative data are collected simultaneously. 60 Information Technologies field teachers working in vocational and technical secondary education institutions, 126 vocational and technical secondary education information technologies students participated in the quantitative dimension of the study, 10 information technologies field teachers, and 5 administrators working in vocational and technical secondary education institutions whose field is information technologies participated in the qualitative dimension. According to the findings of the study, it was seen that the opinions of the teachers about the general robotic coding curriculum and the objectives, content,learning experiences dimension were at the level of agree, while their opinions about the measurement and evaluation dimension were at the level of undecided. In addition, when the qualitative and quantitative data were examined, it was concluded that the teachers had problems in realizing the achievements due to the inadequacy, cost and inaccessibility of the training materials. As a result of the quantitative data obtained from the students, it was concluded that the robotics coding course was at a sufficient level to concretize the programming logic, the robotics coding course increased the interest of the students in the field of information technologies, this course made coding education enjoyable for the students, and the application activities were suitable for the development of the students.

1. Introduction

In the context of globalisation, countries that fail to utilise information and communication technologies (ICT) to their full potential tend to lag behind in terms of economic and social development. Furthermore, it has been observed that developed countries have derived the greatest benefits from ICT. In the initial stages of development, countries such as Brazil, China, India, Israel, Ireland, and others identified the ICT sector as a strategic area for growth and capitalised on this opportunity, resulting in a notable expansion of their economies (Şaf, 2015).

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In order to gain a competitive advantage in the global marketplace and enhance their standard of living, countries are striving to maintain a trajectory of economic growth. In order to achieve this, it is important to implement economic policies that will ensure scientific and technological development (Özer and Kılınç, 2014).

In Turkey, the "Fifth Development Plan" marked the first instance of the incorporation of policies pertaining to ICT. Subsequent development plans have consistently emphasised and included ICT within their scope. The policies required to facilitate the development of the ICT sector were identified, and it was determined that software represented the priority area within this sector. The policies that were adopted provided support for research and development activities in the field of software and for domestic production (Şaf, 2015).

The Eleventh Development Plan, which covers the period from 2019 to 2023, ICT within the scope of sectoral policies. In order to facilitate the National Technology Move in Turkey, a policy has been adopted which entails the preparation of development road maps and infrastructure for a number of sub-branches of ICT, including the Internet of Things, augmented reality, artificial intelligence, big data, cyber security, and robotics. This is in addition to the need for qualified human resources and the orientation of society towards these fields. (Presidency of Strategy and Budget [SBB], 2019)

Qualified human resources, in other words known as human capital, can be defined as the collective knowledge, skills and experience of individuals that have a positive impact on economic productivity and growth. This is achieved by ensuring the effective utilisation of production factors (Atik, 2006). Education is a crucial factor in enhancing a country's qualified human capital (Park, 2005). At a UNESCO meeting of experts on vocational and technical education (VTE), education was identified as a pivotal element in effective development strategies. Furthermore, VTE has the potential to reduce poverty, promote peace, safeguard the environment, enhance quality of life for all, and facilitate sustainable development (Veal et al., 2006).

In the context of the "2023 Education Vision," a novel roadmap was devised for VTE, and the curricula of 47 disciplines in vocational and technical Anatolian High Schools underwent an update. This was achieved by conducting an in-depth examination of the fields, branches, course contents, duration, and materials of vocational and technical secondary education institutions. This examination was conducted with a view to aligning the curricula with the needs of students and the demands of the sector (Board of Education [TTK], 2020). This research is the result of an evaluation of the curriculum for the 10th grade robotics coding course in VTE schools in 2020. In line with the participant-oriented curriculum evaluation approach (POCEA), the objective is to ascertain the opinions of teachers, administrators and students regarding the programme and to identify recommendations for its future development. In pursuit of this goal, this research addresses the following question: What are the opinions of the curriculum's participants (teachers, administrators, students) about the robotic coding 10th grade curriculum and how do the educational conditions of the curriculum in practice align with these opinions?

Purpose of the Study

In order to exert influence in the context of global competition, countries seek to guarantee the continuity of their economic growth. In order to achieve this, economic policies are developed. In the context of economic policy, there is a focus on vocational education, which is seen as a means of providing the human capital that is required by the sector. In order for VTE, which is the source of human capital, to remain abreast of developments in science and technology, curricula are developed and updated on a regular basis. The objective of this research is to ascertain the efficacy of the 10th grade robotics coding course curriculum in the domain of information technology through a participant-oriented curriculum evaluation approach. This research will be conducted with a participatory evaluation approach based on the views of internal stakeholders. The aim is to provide comprehensive and detailed information to the relevant participants and stakeholders (Stufflebeam & Shinkfield, 2007).

The Participant Oriented Curriculum Evaluation Approach

A common feature of models that adopt a participatory curriculum evaluation approach is the involvement of stakeholders, that is to say, individuals with a connection to the curriculum or those who provide support to the curriculum, in the evaluation process (Fitzpatrick et al., 2012). It is the responsibility of participants to obtain and interpret results by engaging in the evaluation process (Green, 2011).

The key strengths of this approach are its pluralistic logic, its focus on reaching, understanding and utilising judgments, its versatility, its suitability for individual and organised learning approaches, and its capacity to highlight specific aspects of the curriculum (Fitzpatrick et al., 2012). This approach shares some characteristics with other approaches and offers a more acceptable evaluation through the involvement of stakeholders. Through systematic research, emotional changes and acquired skills can also be assessed (Stufflebeam & Coryn, 2014). The most powerful aspect of the participatory evaluation approach is that it brings to light the complexity of curriculum with all of these positive features (Uşun, 2012).

10th Grade Robotic Coding Curriculum

In the context of the 2023 Education Vision, it was stated that the content, structure and duration of vocational and technical secondary education programs will be subject to review in order to align them with the demands of the sector and the needs of students (Ministry of National Education-MoNE, 2018). In alignment with the "2023 Education Vision", seven principal objectives have been identified for VET. In accordance with the third article of the seven main goals, the development of the new generation curricula will be undertaken. This is to be carried out within the scope of the Eleventh Development Plan (2019-2023), which is one of the top policy documents of MoNE. This is in accordance with Board Decision No. 21 dated 19 August 2020, whereby the Presidency of the Board of Education of the Ministry of National Education updated the curricula of 47 fields in Vocational and Technical Anatolian High Schools (TTK, 2020).

One of the fields whose curriculum has been updated is information technology, which plays a significant role in the modern era. The annex of the TTKB decision, dated 15/09/2022 and numbered 78, outlines the updates to the Information Technology branches, which have been renamed as the Software Development Branch and the Network Operator Branch (TTK, 2022).

The STEM approach has gained prominence as a means of addressing the demands of the 21st century, offering avenues for the creation of new industrial sectors, enhanced standards of living and expanded employment opportunities (Landivar, 2013). The acronym STEM is derived from the initialisms of the four disciplines: science, technology, engineering, and mathematics (Gonzales and Kuenzi, 2012). In the context of STEM, the responsibility for learning is assumed by the student, who is thereby afforded the opportunity to learn by doing and experiencing (Çorlu, Capraro and Capraro, 2014; Thomas, 2014). Yıldırım (2013a, 2013b) elucidates the concept of STEM as an approach that encourages students to engage in direct learning, facilitates the realisation of students' aspirations, and enables the transfer of knowledge and skills to novel problem-solving contexts. The utilisation of robotic coding studies enables the concretisation of abstract programming commands through their implementation on robotics, thereby facilitating children's involvement in the problem-solving process and the development of their abstract and logical thinking skills (Sullivan et al., 2013; Bers, 2018a). In light of the aforementioned explanations, it can be posited that the STEM approach and robotic coding achievements are compatible. The science, technology, engineering and mathematics fields are frequently employed in robotic coding training (Dönmez, 2017). The robotic coding course has become a requisite within the scope of 21st-century skills, and according to the current framework curriculum of information technologies, the robotic coding course is within the scope of the common compulsory course in both the software development and network operation branches.Vocational education and training programs are developed in accordance with the framework curriculum. Course information forms are utilised to provide detailed subject matter (content), performance descriptions and application activities/templates for a course (MTEGM, Department of Programmes and Instructional Materials, 2020).

2. Methodology

This section presents the research design, the population and the study group, the data collection tools, the data collection process, the procedures for ensuring the validity and reliability of the research, and the data analysis.

2.1. Research Design

The objective of this study is to provide comprehensive and detailed information about the research to the relevant participants and stakeholders through a participatory evaluation approach that involves consultation with internal stakeholders (Stufflebeam & Shinkfield, 2007). The research was designed with the convergent mixed methods design (Creswell & Creswell , 2018). This design is the most well-known mixed research design, whereby both qualitative and quantitative data are collected simultaneously. The data collected are of equal weight and importance to the study. The qualitative and quantitative data are aligned with respect to the theme under investigation. Following the analysis of the collected data, any instances of overlap or incompatibility between the results obtained are examined. While the concordance of the results lends support to the validity of the research, the emergence of different results may provide ideas for new studies (Luis et al., 2021).

The quantitative findings of the study comprised the data gathered from questionnaires completed by information technology teachers and students regarding their perceptions of the robotic coding course curriculum. The qualitative findings, on the other hand, were based on the insights obtained from interviews with information technology teachers and administrators about their views on the aforementioned course curriculum (see Figure 1).

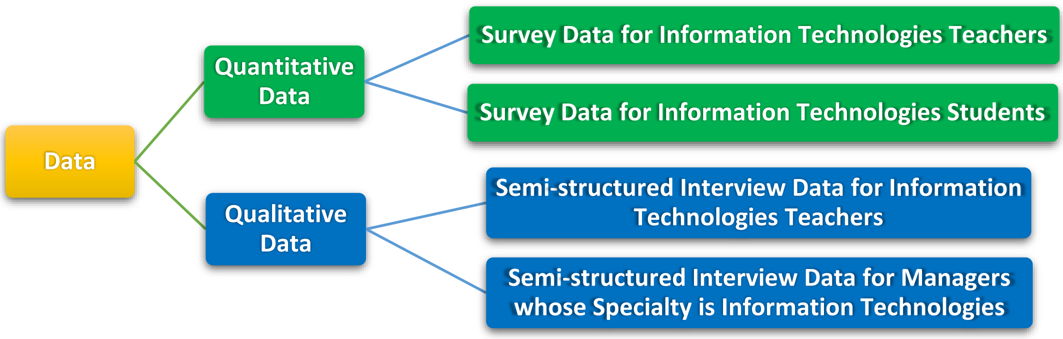

Fig. 1. Research Data

2.2. Participants

The study population comprises information technology field teachers and administrators of vocational and technical secondary education institutions, as well as 11th grade information technology field students. The study sample comprises 60 information technology field teachers and 126 information technology field students employed in vocational and technical Anatolian high schools and multi-programmed Anatolian high schools during the 2022-2023 academic year. A convenience sampling approach was employed to reach vocational education information technology field teachers working in the aforementioned districts during the fall semester of the 2022-2023 academic year, as well as 11th grade vocational education information technology students studying in these districts. Convenient sampling, also referred to as convenience sampling, is a sampling method in which units that are easily accessible and geographically proximate are selected as a sample (Büyüköztürk et al., 2022). The demographic characteristics of the participants are presented in Table 1 and Table 2.

Table 1.
Demographic Information of the Participants in the Quantitative Phase of the Study (Teachers)

	Frequency	Percentage
Gender		
Female	25	41,7
Male	35	58,3
Seniority		
0-5 Years	4	6,7
6-10 Years	9	15
11-15 Years	18	30
16-20 Years	15	25
20 Years and above	14	23,3
Receiving training for robotic coding course		
Yes	31	51,7
No	29	48,3
Education Level		
Bachelor's Degree	45	75
Master Degree	14	23,3
PhD	1	1,7
Graduated Department		
Computer Teacher Education	14	23,3
Computer and Control Teacher Education	7	11,7
Computer Systems Teacher Education	20	33,3
Electronics and Computer Teacher Education	15	25
Computer Engineering	2	3,3
Software Engineering	1	1,7
Other	1	1,7

A review of Table 1 reveals that 41.7% of the participants are female and 58.3% are male. It is evident that 6.7% of the teaching staff have been employed for a period of 0-5 years, 15% for 6-10 years, 30% for 11-15 years, 25% for 16-20 years, 23.3% for 20 years or more. Furthermore, 51.7% of the teaching staff have received training in robotic coding, while 48.3% have not received any training in this area. The majority of teachers (75%) have obtained a Bachelor's degree, while 23.3% have a Master's degree, 1.7% have a Doctorate degree, 23.3% have a degree in Computer Education, 11.7% have a degree in Computer and Control Teacher Education, 33.3% have a degree in Computer Systems Teacher Education, 25% have a degree in Electronics and Computer Teacher Education, 3.3% have a degree in Computer Engineering, 1.7% have a degree in Software Engineering, and 1.7% have obtained an alternative degree.

Table 2.
Demographic Information of the Participants in the Quantitative Phase of the Study (Student)

	Frequency	Percentage
Gender		
Female	52	41,3
Male	74	58,7
Program Trained		
11th Grade Anatolian Technical Program	8	6,3
11th Grade Anatolian Vocational Program	104	82,5
11th Grade Other	14	11,1
Specialist Program Trained		
Network Operations and Cyber Security	19	15,1
Software Development	107	84,9

Upon analysis of Table 2, it becomes evident that 41.3% of the participants are female students, while 58.7% are male students. Six point three percent of the students are enrolled in the eleventh grade of the Anatolian Technical Programme, eighty-two point five percent of the students are enrolled in the eleventh grade of the Anatolian Vocational Programme, and eleven point one percent of the students are enrolled in the eleventh grade of other programmes. While 15.1% of the students receive specialised education in the field of Network Operator and Cyber Security, the remaining 84.9% receive specialised education in the field of Software Development.

The study group from which the qualitative data were collected was selected using the criterion sampling method, which is a purposeful sampling method. Interviews were conducted with 10 teachers and 5 administrators who met the criteria of teaching in the robotics coding course, having previously taught this course and being a voluntary participant within the scope of the study. The demographic information of the interviewed teachers and administrators is presented in Tables 3 and 4.

Table 3.
Demographic Information of the Participants Forming the Qualitative Phase of the Study (Teacher)

	GENDER	SENIORITY	GRADUATED EDUCATION PROGRAM	EDUCATION LEVEL
T1	Female	11-15 years	Computer and Control Teacher Education	**B**achelor's degree
T2	Male	20 years and above	Electronics and Computer Teacher Education	Master Degree
T3	Female	0-5 years	Electronics and Computer Teacher Education	Lisans
T4	Male	16-20 years	Electronics and Computer Teacher Education	Master Degree
T5	Female	11-15 years	Computer and Control Teacher Education	**B**achelor's degree
T6	Male	16-20 years	Computer Teacher Education	**B**achelor's degree
T7	Male	20 years and above	Computer Systems Teacher Education	**B**achelor's degree
T8	Male	16-20 years	Computer and Control Teacher Education	Master Degree
T9	Female	11-15 years	Computer Systems Teacher Education	Master Degree
T10	Male	16-20 years	Computer Systems Teacher Education	**B**achelor's degree

Table 3 reveals that four of the participants are female, six are male, one has been employed for between zero and five years, three have been employed for between 11 and 15 years, four have been employed for between 16 and 20 years, and two have been employed for 20 years or more. Six participants graduated from undergraduate programmes, four graduated from graduate programmes, one graduated from computer teaching, three graduated from computer and control teaching, three graduated from computer systems teaching, and three graduated from electronics and computer teaching.

Table 4.
Demographic Information of the Participants Forming the Qualitative Phase of the Study (Administrator)

	GENDER	SENIORITY	GRADUATED EDUCATION PROGRAM	EDUCATION LEVEL
A1	Female	20 years and above	Computer Teacher Education	**B**achelor's degree
A2	Male	20 years and above	Computer Systems Teacher Education	Master Degree
A3	Male	16-20 yıl	Computer Teacher Education	**B**achelor's degree
A4	Male	16-20 yıl	Electronics and Computer Teacher Education	Master Degree
A5	Female	11-15 yıl	Computer Systems Teacher Education	**B**achelor's degree

Table 4 reveals that two of the participants are female, three are male, one has been employed for 11-15 years, two have been employed for 16-20 years, and two have been employed for 20 years or more. Additionally, three possess a Bachelor's degree, two hold a Master's degree, two have graduated from computer teaching, two have graduated from computer systems teaching, and one has graduated from electronics and computer teaching.

2.3. Data Collecting Instruments

- The Teacher Opinion Surveys and the Student Opinion Surveys

In the quantitative dimension of the study, the "10th Grade Robotic Coding Curriculum (2020) Teacher Opinions Questionnaire" was developed to examine teacher opinions on the robotic coding curriculum (RCC) in four dimensions: objectives, content, learning experiences and measurement and evaluation. The "10th Grade Robotic Coding Curriculum (2020) Student Opinions Questionnaire" was also developed to examine student opinions.

The items in the questionnaires were constructed using a five-point Likert scale, with the following responses: (5) Strongly agree, (4) Agree, (3) Undecided, (2) Disagree, and (1) Strongly Disagree. The "10th Grade Robotic Coding Curriculum (2020) Teacher Opinions Questionnaire" comprises a total of 32 items. Information regarding the gender, professional seniority, type of school graduation, graduation status, and in-service training for the robotic coding course was obtained through the use of eight items in the questionnaire's introductory section, which served to examine the participants' demographic characteristics. The A section of the questionnaire addressed opinions about the program in general. The B section focused on the objectives component of the program. The C section concentrated on the content (subjects) component. The D section explored the learning experiences component. The E section concentrated on the measurement and evaluation component.

The 10th grade RCC (2020) student opinions questionnaire form includes items related to information technologies students' gender, the program they are studying (Anatolian Technical Program, Anatolian Vocational Program), the branch program they are studying (network operator and cyber security, software development), and eight items to obtain opinions on the general RCC. These items are included in order to examine the demographic characteristics of the students.

Prior to developing the questionnaires, a review of the literature was conducted, and the questionnaire items from master's theses published on related topics (Konanç, 2022; Akdoğan, 2020; Erbilen Sak, 2008; Kandemir & Tok, 2017) were examined. It was observed that the items were generally used in these studies with similar expressions. In light of the questionnaires utilized in the examined studies, appropriate questionnaire items were created by considering the specific circumstances pertinent to the vocational and technical secondary education robotic coding program.

The Cronbach's alpha coefficient of the "10th Grade Robotic Coding Curriculum (2020) Teacher Opinions Questionnaire" was determined to be 0.947, while the Cronbach's alpha coefficient of the "10th Grade Robotic Coding Curriculum (2020) Student Opinions Questionnaire" was found to be 0.948 , indicating that the items used in the questionnaire are consistent with each other and measure the same feature.

- The Teacher Interview Form and the Administrator Interview Form

In order to gain insight into the relevant literature on semi-structured teacher and administrator interviews, the semi-structured interview forms used in the qualitative dimension of the study were first reviewed. The open-ended questions in the semi-structured interview forms were prepared for the objectives, content, learning experiences, measurement and evaluation processes dimensions of RCC, and the opinions of experts were sought to ensure the validity of the interview forms. In order to achieve this, the necessary corrections were made with the input of two experts from the field of curriculum and insruction, and one expert from the field of measurement and evaluation. As part of the preliminary study, three VTE information technologies field teachers from outside the sample were consulted to examine the interview forms, and some items were updated as a result of their input. Following this, the interview forms were piloted and it was decided that they were fit for purpose.

2.4. Data Analysis

The primary objective of a general survey study is to provide a descriptive account of the subject matter under investigation. Consequently, researchers typically present the data they have collected using descriptive statistics, such as rates, percentages, frequencies and averages (Gürbüz & Şahin, 2018). In this study, the frequency (f) and percentage (%) distributions were employed to analyse the data obtained from the questionnaires completed by teachers and students.

In the analysis and interpretation of the data, the following grades were obtained based on the calculation of $\frac{\text{number of options} - 1}{\text{number of options}}$. The answers were then interpreted according to these grades, as follows: 'Strongly Disagree' (1.00 - 1.80); 'Disagree' (1.81 - 2.60); 'Neutral' (2.61 - 3.40); 'Agree' (3.41 - 4.20); 'Strongly Agree' (4.21 - 5.00).

In the study, qualitative data were subjected to a descriptive analysis. In the descriptive analysis method, direct quotations are included in the study to ensure the accuracy of the results obtained. Conversely, the descriptive analysis method is applicable to studies that examine the curriculum in terms of its four fundamental components: objectives, content, learning experiences and measurement and evaluation. As the four basic components of the curriculum and its features have already been documented in the existing literature (Şen & Yıldırım, 2021), Consequently, direct quotations were incorporated from qualitative data to reinforce the precision of the quantitative data presented in the study. The descriptive analysis method was employed due to the availability of the established bases and categories within the research framework in the existing literature.

The audio recordings of the interviews with the teachers and administrators were transcribed individually for each participant, resulting in the creation of a data set. The data sets were subjected to analysis, and codes were developed for the views expressed by teachers and administrators. These codes were then placed in appropriate categories. In order to maintain confidentiality, the names of the participants were replaced with pseudonyms, such as T1 and T2 for teachers and A1 and A2 for administrators.

2.5. Validity and Reliability

In order to enhance the internal validity of the research, the opinion of an expert in the field of curriculum and instruction was sought to confirm the suitability of the codes obtained for the categories and themes. The coding of the expert and that of the researcher were then compared. In order to enhance the internal validity of the research, the codes were independently coded by the researcher and an expert in the field of curriculum and instruction. The codings made by the expert and the researcher were compared, and the reliability of the results was tested separately for the participants using the reliability formula proposed by Miles and Huberman (1994). The reliability coefficient of the coding of the data pertaining to the teachers' opinions was calculated as 23/(23+3) *x* 100=0.88, while the reliability coefficient of the coding of the data pertaining to the administrators' opinions was calculated as 20/(20+2) *x* 100=0.90. These figures were obtained through the application of the reliability formula, which is defined as agreement / (agreement + disagreement) *x* 100. As stated by Miles & Huberman (1994) and Patton (2002), it is anticipated that the consensus rate between coders will be at least 80%. The codes, categories and themes belonging to these codes are presented in different sections in terms of teacher and administrator views, with tables in the findings section.

2.6. Findings

This section presents the general views of information technology teachers and administrators regarding the 10th grade robotics coding course curriculum. It examines their views on the objective, content, learning experiences and measurement and evaluation dimensions of the curriculum.

The qualitative and quantitative data were subjected to parallel analysis. In parallel data analysis, qualitative and quantitative data are analysed separately, without any influence from one another (Tashakkori & Teddlie, 2003; Mertkan, 2015). The findings obtained from the analyses are typically interpreted and presented separately, without being combined (Onwuegbuzie & Collins, 2007). In this context, the data obtained from the questionnaires using the quantitative method and the individual interview data obtained using the qualitative method were analysed independently of each other.

Following the presentation of the quantitative findings, an attempt was made to elucidate the qualitative findings that were either consistent or contradictory with these findings, with the aim of obtaining a comprehensive perspective on the findings. Subsequently, the quantitative findings pertaining to the teachers' and students' perspectives on the programme as a whole were presented. This was followed by the integration of the qualitative and quantitative findings on the programme's objective, content, learning experiences and measurement and evaluation dimensions (Figure 2).

Fig. 2. Transfer of Findings

- **Findings Related to the Objective Component of the Curriculum**

Table 5.
Teachers' Opinions on the Objective Component

		Strongly Disagree	Disagree	Undecided	I agree	Strongly Agree	$\bar{x}$
The objectives are expressed in a clear and understandable way.	**n**	3	9	36	12	3	3,95
	%	5,0	15,0	60,0	20,0	5,0	
The objectives are consistent and interrelated.	**n**	1	1	10	36	12	3,95
	%	1,7	1,7	16,7	60,0	20,0	
The objectives meet the needs of the learner.	**n**	1	4	8	35	12	3,88
	%	1,7	6,7	13,3	58,3	20,0	
The objectives support the process of skills development in the organisation.	**n**	5	14	16	21	4	3,08
	%	8,3	23,3	26,7	35,0	6,7	
The objectives are appropriate to the learner's level of cognitive development.	**n**	1	6	13	28	12	3,73
	%	1,7	10,0	21,7	46,7	20,0	

The objectives are appropriate to the learner's level of affective development.	**n**	3	4	15	27	11	3,65
	%	5,0	6,7	25,0	45,0	18,3	
The objectives are appropriate to the level of psychomotor development of the students.	**n**	3	4	15	27	11	3,97
	%	5,0	6,7	25,0	45,0	18,3	

Looking at Table 5, the highest mean $\bar{x}$=3.97 was for the item 'The gains are appropriate to the level of psychomotor development of the pupils' and the lowest $\bar{x}$=3.08 was for the item 'The gains support the skills training process in the company'.

The mean of the teachers' opinions on the objective component of the curriculum was $\bar{x}$=3.75. This shows that the teachers' opinions on the objective component of the curriculum are at the level of 'agree'. Considering this result, it can be said that computer science teachers' opinions on the objective dimension of the 10th grade robotics coding course curriculum are positive.

Table 6.
Code List of Teachers' Opinions Regarding the Objective Component

Theme	Category	Code
Curriculum	Objective	Appropriate for student development
		Inadequate readiness
		Failure to realise objectives
		Objectives are related to each other
		Unacquired objectives
		Basic electronics objectives

The code list in Table 6 was obtained as a result of the analysis of the findings related to the objective component of the curriculum in the interviews with the teachers. Sample statements of teachers regarding these findings are given below:

"The objectives are prepared in accordance with the holistic development of students. Students' work on concrete objects contributes more to the development of their creativity, which allows our students to feel good about themselves as they reach the pleasure of learning more easily. In addition, the use of sensors or circuit elements increases hand-eye coordination and improves hand skills. The objectives in the curriculum are consistent with each other." T1

"The learning objectives are arranged in accordance with the cognitive, affective and psychomotor development of the 10th grade age group, but when we look at the curriculum in practice, the realisability situation can sometimes be problematic due to the insufficient level of readiness of our students. Some students have low motivation, have no interest in informatics, and some have insufficient academic knowledge." T2

"Making circuit installations in a physical way is effective in achieving objectives. While children are supported cognitively during the coding process, children develop psychomotor during circuit installations. In addition, sometimes the circuit set up by the student may not work, the code he/she writes may give an error. The student patiently searches for the error in the codes in the circuit. In this sense, I think they are also supported in the affective field." T3

Table 7.
Code List of Administrator Opinions Regarding the Objective Component

Theme	Category	Code
Curriculum	Objective	Appropriate for student development Inadequate readiness Failure to realise objectives Objectives are related to each other Unacquired objectives Basic electronics objectives

Table 7 presents the list of codes derived from the analysis of the interviews with the administrators. The following section presents sample statements from teachers regarding these findings:

"The objectives are appropriate for the development of students. Although the realisability of the programme according to the student level is high, we do not have a robotics workshop because our school is not currently providing education in its own building, so we have problems with realising the objectives. We are trying to implement the programme through Tinker Cad, not through robotics kits."A1

"The learning objectives in the programme contribute to the development of students in all aspects in line with the school's facilities. The learning objectives in the curriculum are consistent and related to each other and are appropriate for the developmental levels of the students. However, the high number of students with low academic achievement slows down our progress in the course. There should also have been basic electronics objectives within the scope of this course. Since the children do not have these objectives, we also teach basic electronics in the course, except for the curriculum." A2

"I think that the learning objectives are appropriate for the developmental level of the students, but their level of readiness is insufficient. There is a need for information about electronic circuits in the robotic coding curriculum. Since the basic electronics course was removed from the framework curriculum, students do not have the basic electronics objectives that are prerequisites for the robotics coding course." A5

- **Findings Related to the Content Component of the Curriculum**

Table 8.
Teachers' Opinions on the Content Component

		Strongly Disagree	Disagree	Undecided	I agree	Strongly Agree	$\bar{x}$
The content is organized according to teaching principles (relevance to the student, from simple to difficult, from near to far, etc.).	n	3	3	12	26	16	3,82
	%	5,0	5,0	20,0	43,3	26,7	
The content is easy, plain and understandable.	n	7	12	24	17	7	3,85
	%	11,7	20,0	40,0	28,3	11,7	
The content is connected to real life.	n	3	4	12	29	12	3,72
	%	5,0	6,7	20,0	48,3	20,0	
The content makes students' learning algorithms and programming enjoyable.	n	2	5	12	26	15	3,78
	%	3,3	8,3	20,0	43,3	25,0	
4 weekly lesson hours are sufficient to acquire the knowledge and skills in the content.	n	5	13	17	16	9	3,18
	%	8,3	21,7	28,3	26,7	15,0	

The topics in the content are prerequisites for each other.	n	4	10	35	11	4	3,88
	%	6,7	16,7	58,3	18,3	6,7	
There are topics that I think should be removed from the curriculum.	n	9	14	14	13	10	3,02
	%	15,0	23,3	23,3	21,7	16,7	
There are topics that I think should be added to the curriculum.	n	2	4	14	23	17	3,82
	%	3,3	6,7	23,3	38,3	28,3	

When Table 8 is examined, it is observed that the IT teachers' opinions about the content dimension of the 10th grade robotics coding course curriculum are at the level of "agree" with the highest mean $\bar{x}$=3,88 in the item "The topics in the content are prerequisites for each other." and at the level of "undecided" with the lowest mean $\bar{x}$=3,02 in the item 'There are topics that I think should be removed from the curriculum.

The mean of the teachers' opinions about the content component of the curriculum was found to be $\bar{x}$=3,63. According to this, it is seen that teachers' opinions about the content element of the curriculum are at the level of "agree". Considering this finding, it can be said that the views of information technologies teachers on the content dimension of the 10th grade robotics coding course curriculum are positive.

Table 9.
Code List of Teachers' Opinions Regarding the Content Component

Theme	Category	Code
Curriculum	Content	Aligns with learning objectives
		Appropriate for student development
		Learning units that support each other
		Intensive content
		Insufficient content
		Basic electronic content
		Appropriate for student needs
		Sufficient content

Table 9 presents a list of codes derived from teachers' perspectives on the content element. The following sample statements illustrate the teachers' responses to these findings:

"There is a significant amount of detail in the content that I think is unnecessary. This caused the content to be dense. Instead of these details, I think that there should be more realistic, realistic and real-life applications." T2

"I think the content is insufficient. When I say insufficient, I mean that there is no basic information. Electronic circuit elements are used in the applications in the learning units, but students have no knowledge of electronic circuit elements. The content of the course could have included basic electronic information, working logic of circuit elements, etc." T3

"The course content and the book are quite sufficient. The content was created in accordance with the learning objectives. However, the fact that there is not enough material for each student to practice individually makes the lesson a little inefficient. The content is appropriate for students' interests and needs. With the development of technology, young people are interested in robotic activities." T8

"The content is prepared in accordance with the learning objectives, but I think that the content is intensive according to the duration of the course hours. The units support each other, but as I mentioned before, the fact that the students do not have basic electronic knowledge and the need for electronic knowledge in the subjects in the learning units negatively affects the learning-teaching process. In addition, basic electronics knowledge should be given to students before this course or at the beginning of the curriculum." T10

Table 10.
Code List of Administrator Opinions Regarding the Content Component

Theme	Category	Code
Curriculum	Content	Aligns with learning objectives Appropriate for student development Learning units that support each other Sufficient content Basic electronic content Appropriate for student interest Simulation software

The analysis of the interviews conducted with the administrators regarding the content element resulted in the formation of the codes presented in Table 10. The following sample statements from teachers illustrate the findings in question:

"Due to the removal of the basic electronics and measurement course from the curriculum in the new framework curriculum, there are problems with student readiness in the parts of the curriculum related to electronics. For this reason, I think that information about basic electronics should be added to the content of this course." A1

"While the content should go from simple to difficult, the topics in the module/learning units are mixed. Besides, I think that the subjects are appropriate for the level and interest of the students." A2

"The content is sufficient and compatible with the course hours. The units are prepared in accordance with the learning objectives. Students like the content of this course. The lesson is enjoyable." A3

"Learning units are sufficient in terms of content. The subjects support each other. The students are very interested in the lesson and the content is appropriate for the level of the students." A4

"The intensity and scope of the content is appropriate for the objectives and the duration of the lesson. Learning units support each other from easy to difficult. The content of the curriculum attracts students' attention. Children like it when they see a tangible product." A5

- **Findings Related to the Learning Experiences Component of the Curriculum**

Table 11.

Teachers' Opinions on the Learning Experiences Component

		Strongly Disagree	Disagree	Undecided	I agree	Strongly Agree	$\bar{x}$
There are enough examples of practice activities in the curriculum.	**n**	2	11	11	29	7	3,47
	%	3,3	18,3	18,3	48,3	11,7	
The practice activities in the curriculum are appropriate for this age group.	**n**	0	3	7	38	12	3,98
	%	0	5,0	11,7	63,3	20,0	
The practice activities in the curriculum prepare a fun environment for programming education.	**n**	2	6	6	32	14	3,83
	%	3,3	10,0	10,0	53,3	23,3	

Implementation activities are capable of achieving the learning objectives.	**n**	0	4	9	32	15	3,97
	%	0	6,7	15,0	53,3	25,0	
The time given for the practice activities is sufficient.	**n**	4	6	11	29	10	3,58
	%	6,7	10,0	18,3	48,3	16,7	
The class size is appropriate to follow the students one-to-one during the practice activities.	**n**	12	10	6	25	7	3,08
	%	20,0	16,7	10,0	41,7	11,7	
The materials required for the practice activities are easily accessible.	**n**	17	18	6	14	5	2,53
	%	28,3	30,0	10,0	23,3	8,3	
The materials required for practice activities are economical.	**n**	22	16	4	12	6	2,40
	%	36,7	26,7	6,7	20,0	10,0	
The textbook is consistent with the curriculum.	**n**	2	3	8	32	15	3,92
	%	3,3	5,0	13,3	53,3	25,0	

Upon examination of Table 11, it becomes evident that the highest mean value of 3.98 is observed for the item "The practice activities in the curriculum are appropriate for this age group,", which is rated at the level of "agree". Conversely, the lowest mean value of 2.40 is observed for the item "The materials required for thepractice activities are economical", which is rated at the level of "disagree". In light of these findings, it can be posited that the teaching staff hold a negative view with regard to the economy of application materials.

The mean of the teachers' opinions about the learning experiences of the curriculum was found to be 3.42. This indicates that the teachers' opinions about the learning experiences of the curriculum are at the level of "agree," which suggests that the opinions of information technology teachers about the learning experiences of the 10th-grade robotic coding course curriculum are positive.

Table 12.
Code List of Teachers' Opinions Regarding the Learning Experiences Component

Theme	Category	Code
Curriculum	Learning Experiences	Place (workshop) problem Insufficient material High number of students in classes Costly material Insufficient equipment

Table 12 presents the list of codes derived from the analysis of teacher interviews pertaining to the learning experiences component of the curriculum. The following sample statements illustrate the teachers' perspectives on these findings:

"There is no robotic coding workshop in our school. As much as possible,practice activities are conducted in the computer laboratory with the educational materials available. As this course is one of the compulsory specialisation courses, it is essential that the our ministry provides each student with the requisite materials for the content. The current educational materials are inadequate due to overcrowded classrooms. "T1

"I know that the supply of the necessary materials for thepractice activities is a problem for many schools. I think it is very important to overcome this problem. In light of the considerable high number of students

in the classes and the dearth of available materials, it would be advantageous to pursue a strategy of group work for the activities. Furthermore, the provision of peer learning and group competition also results in more positive feedback than would be the case with individual work." T2

"The issue of place is a significant challenge, with high numbers of students in each class and educational materials are easily perishable, so it is a problem to provide these materials. It would be prudent to avoid applications that require expensive materials, such as a battery-powered car. The proposed solution is not financially viable without the purchase of lipo batteries. The cost of batteries for 34 students, as of today, is estimated to exceed 30 thousand liras. It is not feasible to provide each student with a lipo battery. "The child is unaware that they are capable of achieving the desired outcome without attempting it." T5

"It is not always feasible to provide the requisite materials for the proposed practical activities due to their cost. Providing educational material support to schools at the beginning of the academic year would enhance the efficiency of the course. Conversely, the high number of students in each class and the insufficient number of computers and educational materials negatively impact the practical activities process." T9

Table 13.
Code List of Administrator Opinions Regarding the Learning Experiences Component

Theme	Category	Code
Curriculum	Learning Experiences	Place (workshop) problem
		Insufficient material
		High number of students in classes
		Costly material
		Insufficient equipment

Upon analysis of the data from the administrator interviews, the administrator opinion codes pertaining to the learning experiences component of the curriculum are presented in Table 13. The following sample statements from teachers illustrate their perspectives on these findings:

"Since our school cannot provide education in its own building, we do not have a robotic coding workshop, so the supply of educational materials cannot be done at the moment. The computers in our existing computer labs have very low specifications and we do not have enough computers for every student to benefit from." A1

"The computers in the workshops do not have sufficient hardware features to handle current programmes. The number of students in the classes is high. Since the robotics coding course is an applied course, the number of students in the classes should be appropriate for educational materials. The number of students in our class is high and the robotics materials required forpractice activities are insufficient." A2

"The materials required for thepractice activities are available in our school, they are provided through the general budget, but we do not currently have a separate workshop for Robotic Coding. In addition, robotic coding training materials are quite costly. Most schools do not have a workshop for this course anyway. If there is a separate robotic coding workshop, it will be possible to do all the application activities in the curriculum. In addition, unfortunately, we have too many students in the class." A4

- **Findings Related to the Measurement and Evaluation Component of the Curriculum**

Table 14.

Teachers' Opinions on the Measurement and Evaluation Component

		Strongly Disagree	Disagree	Undecided	I agree	Strongly Agree	$\bar{x}$
Measurement and evaluation techniques (such as observation form, rating scale and rubric) proposed in the curriculum are appropriate for measuring the objectives.	n	2	6	13	28	11	3,67
	%	3,3	10,0	21,7	46,7	18,3	
The practice activities proposed to be carried out within the scope of measurement and evaluation are clear and understandable.	n	2	2	6	36	14	3,97
	%	3,3	3,3	10,0	60,0	23,3	
The practice activities proposed to be carried out within the scope of measurement and evaluation are appropriate for the student level.	n	2	4	11	33	10	3,75
	%	3,3	6,7	18,3	55,0	16,7	
The practice activities proposed to be carried out within the scope of measurement and evaluation are feasible in terms of time.	n	4	9	12	28	7	3,42
	%	6,7	15,0	20,0	46,7	11,7	
The educational materials required for the practical activities proposed to be carried out within the scope of measurement and evaluation are easily accessible.	n	16	17	8	13	6	2,60
	%	26,7	28,3	13,3	21,7	10,0	
The educational materials required for thepractice activities proposed to be carried out within the scope of measurement and evaluation are economical.	n	18	18	6	12	6	2,50
	%	30,0	30,0	10,0	20,0	10,0	

Examining Table 14, it can be seen that the highest mean $\bar{x}$=3.97 for the dimension of measurement and evaluation of the curriculum of the 10th grade coding course is at the level of 'agree' in the item 'The practice activities proposed to be carried out within the scope of measurement and evaluation are clear and understandable', while the lowest mean $\bar{x}$=2.50 is at the level of 'disagree' in the item 'The training materials required for thepractice activities proposed to be carried out within the scope of measurement and evaluation are economical', while the lowest mean $\bar{x}$=2.50 is at the level of 'disagree' in the item 'The training materials required for thepractice activities proposed to be carried out within the scope of measurement and evaluation are economical' and considering this value it can be said that teachers have negative opinions about the economy of training materials.

Considering the dimension of training situations ($\bar{x}$=2.40) and measurement-evaluation ($\bar{x}$=2.50), it can be said that teachers have negative opinions about the economy of materials needed within the framework ofpractice activities.

The mean of the teachers' opinions on the dimension measurement-evaluation of the curriculum was found to be $\bar{x}$=3.32. This means that the teachers' opinions on the measurement-evaluation element of the curriculum are at the level of "undecided".

Table 15.
Code List of Teachers' Opinions Regarding the Measurement-Evaluation Component

Theme	Category	Code
Curriculum	Measurement-Evaluation	Implementation exam Physicalpractice Simulation software Diversification of measurement activities

Table 15 presents the codes derived from the analysis of interviews with teachers on the assessment and evaluation of the programme. The table includes illustrative statements from teachers on these findings:

"While preparing thepractice activities, it should have been considered that the physical facilities of the schools may not be able to fulfil these activities. What I mean by physical facilities are robotics sets, electronic materials and computers. In cases where our educational materials are sufficient, we do measurement and evaluation withpractice s. When the materials are insufficient, we conduct assessment and evaluation through the simulation software. Thepractice activities in the curriculum are prepared appropriately for assessment and evaluation." T1

"Since this course is a practical activity-based course, we try to make measurement and evaluation with applications. We do the recommendedpractice activities in the form of group work due to lack of materials. In a way, this situation is useful because it directs students to co-operative learning. Of course, if the educational materials were sufficient, it would be better to apply the activities individually." T2

"Assessment and evaluation activities were prepared in accordance with the framework curriculum, but due to the high number of students in the classes and the insufficiency of educational materials, the physical applicability of thepractice activities in the curriculum is not possible, so we proceed with Tinker Cad simulation software in the lesson. In other words, the curriculum is prepared but the curriculum is not realistic. While preparing the curriculum, the facilities of the schools were ignored. If the ministry had provided educational material support to all schools for this course before thepractice of the robotic coding curriculum, students would learn better by doing and experiencing." T6

"The fact that the work done by the students can be tested with different application questions makes the measurement and evaluation more healthy and reliable. The curriculum can be enriched with more examples ofpractice activities and questions for measurement and evaluation. We choose the applications from the curriculum for which our educational materials will be sufficient and physically apply them." T7

Table 16.
Code List of Administrator Opinions Regarding the Measurement-Evaluation Component

Theme	Category	Code
Curriculum	Measurement-Evaluation	Implementation exam Physicalpractice Simulation software

As a result of the analysis of the data obtained in the interviews with the administrators regarding the measurement and evaluation component of the curriculum, the codes in Table 16 were obtained. Examples of teachers' statements on these findings are given below:

"We do the measurement and evaluation in the curriculum practically. When the training materials are sufficient, we physically carry out the application activities. If the materials are not enough, we carry out measurement and evaluation activities with simulation software." A1

"Assessment and evaluation activities in the curriculum are arranged in accordance with the practical exam. We use Tinker Cad simulation software for the practical activities where there are no or insufficient training materials, and we directly physically carry out the practical activities where the materials are sufficient. Measurements carried out with physical application are more meaningful." A2

"We carry out measurement and evaluation activities in a practical way in accordance with the curriculum. Since our materials are sufficient, we carry out measurement and evaluation activities with physical application activities." A4

- **Findings Regarding the Whole Curriculum**

In the quantitative phase of the research, opinions to the whole curriculum were obtained through teacher and student questionnaires.

Table 17.
Findings Related to Teachers' Opinions to the Whole Curriculum

		Strongly Disagree	Disagree	Undecided	I agree	Strongly Agree	$\bar{x}$
The curriculum provides sufficient guidance to the teacher during the teaching process.	n	1	9	12	26	12	3,65
	%	1,7	15,0	20,0	43,3	20,0	
The syllabus is sufficient for students to understand the logic of computer programming.	n	1	10	11	27	11	3,62
	%	1,7	16,7	18,3	45,0	18,3	

Looking at Table 17, 26 of the teachers (43.3%) agreed with the statement 'The curriculum guides the teacher sufficiently in the teaching process'. The mean of the teachers' opinions on this item is $\bar{x}$=3.65 and this value shows that the mean of the teachers' opinions is at the level of 'agree'.

For the statement 'The curriculum is sufficient for students to concretise the logic of computer programming', 27 of the teachers (45.0%) responded as 'agree'. The mean of teachers' opinions on this item is $\bar{x}$=3.62 and this value shows that the mean of teachers' opinions is at the level of 'agree'.

The mean of the teachers' opinions to the whole curriculum is $\bar{x}$=3.63. According to this, it can be seen that teachers' opinions to the whole curriculum are at the level of "agree" and it can be said that teachers have positive opinions about the whole curriculum.

Table 18.
The Most Important Problems of the Teachers Concerning The Robotic Coding Course

	Frequency	Percentage
Lack/obsolescence/oldness/absence/inadequacy of tools, equipment and materials	42	70,0
Qualification of teachers	2	3,3
High number of pupils in classes	5	8,3
Pupils' level of readiness (interest, knowledge, motivation)	9	15,0
There are no major problems that I have observed	2	3,3

When analysing Table 18, 42 (70%) of the teachers see the lack/obsolescence/absence/inadequacy of tools, equipment and materials needed for the course, 2 (3.3%) see the teachers' competence, 5 (8.3%) see the high number of students in the classes, 9 (15%) see the students' readiness level (interest, knowledge, motivation) as a problem, while 2 (3.3%) stated that they did not observe any significant problem for the course.

Table 19.
Findings Related to Students' Opinions to the Whole Curriculum

		Strongly Disagree	Disagree	Undecided	I agree	Strongly Agree	$\bar{x}$
Robotic coding course increases my interest in the field of information technologies.	n	19	5	16	33	53	3,76
	%	15,1	4,0	12,7	26,2	42,1	
Robotic coding course increases my interest in coding (programming languages and programming).	n	14	10	17	37	48	3,75
	%	11,1	7,9	13,5	29,4	38,1	
Robotic coding course makes my coding (programming) knowledge concrete.	n	16	8	23	38	41	3,63
	%	12,7	6,3	18,3	30,2	32,5	
Robotic coding course makes the coding (programming) education process more understandable.	n	14	11	21	35	45	3,68
	%	11,1	8,7	16,7	27,8	35,7	
4 lesson hours per week is sufficient for me to gain the knowledge and skills in the content of the robotic coding course.	n	14	14	26	33	39	3,55
	%	11,1	11,1	20,6	26,2	31,0	
The difficulty level of thepractice activities within the scope of the robotic coding course is appropriate for my development level.	n	15	8	26	36	41	3,63
	%	11,9	6,3	20,6	28,6	32,5	
Our teacher frequently evaluates our learning by doingpractice activities to determine that we have learnt the skills within the scope of the robotic coding course.	n	11	10	16	36	53	3,87
	%	8,7	7,9	12,7	28,6	42,1	
In the robotic coding course, we have the opportunity to dopractice activities repeatedly to reinforce our knowledge and skills.	n	12	6	19	35	54	3,90
	%	9,5	4,8	15,1	27,8	42,9	

In Table 19, when the opinions of the 11th grade students in the field of information technologies about to the whole 10th grade robotic coding course curriculum are examined, it is observed that the highest mean is in the item 'In the robotic coding course, we have the opportunity to practice repeatedly in order to reinforce our knowledge and skills.' with $\bar{x}$=3,90, while the lowest mean is in the item '4 lesson hours per week is sufficient for me to gain the knowledge and skills in the content of the robotic coding course.' with $\bar{x}$=3,55.

The mean of the students' opinions about to the whole curriculum was found to be $\bar{x}$=3,72. According to this, it is seen that the students' opinions about to the whole RCC are at the level of "agree" and in this context, it can be said that the opinions of information technologies students towards the 10th grade robotic coding course curriculum are positive.

Table 20.
Areas in the Robotics Coding Course Where Students Feel Inadequate

	Frequency	Percentage
Electronic knowledge (resistance, current, voltage, etc.)	34	56,67
Electronic circuit installation / design (circuit element recognition, connection)	36	60
Algorithm creation and coding	37	61,67

Looking at Table 20, 34 (56.67%) of the students stated that they felt inadequate in electronic knowledge (resistance, current, voltage, etc.), 36 (60%) in electronic circuit installation/design (circuit element recognition, connection), 37 (61.67%) in algorithm creation and programme writing process.

3. Conclusion and Suggestions

It is seen that the teachers' opinions on the whole curriculum, the objectives, content and learning experiences dimensions of the RCC are at the level of agree, while their opinions on the measurement and evaluation dimension are at the level of undecided. According to the data obtained from teacher and administrator interviews in the qualitative dimension of the research, it was concluded that teachers and administrators found the objectives appropriate for the development of students.

It was understood that the teachers' opinions on the content component of the curriculum were at the level of agree, the content obtained from the interviews was consistent with the objectives, the course content was appropriate for student development, and the learning units in the content supported each other. It is observed that the administrator views coincide with the teacher views.

Teachers' opinions at the level of agreeing with the learning experience of the curriculum are supported by the opinions obtained from the interviews about the place/workshop problem, inadequacy of the materials required for the application activity, being costly, and overcrowded classrooms. The fact that almost all of the teachers see the lack/ obsolescence/absence/inadequacy of tools, equipment, materials as the most important problem within the place of the robotic coding course and the teachers' opinions on the learning experiences of the curriculum as place/ workshop problem, inadequacy of the materials for the application activity, being costly. In the light of the findings obtained from the teacher questionnaires in the quantitative dimension of the research, it can be concluded that teachers have a significant shortage of materials/equipment within the place of this course in the light of the fact that the answers given to the item that the materials of the application activity related to the educational status and measurement and evaluation dimension are easily accessible and economical are at the level of disagreement. Sönmez and Şahinkayası (2021), in their study, revealed that teachers had problems in the provision of materials and equipment within the place of robotic coding activities, especially due to financial difficulties, and that the materials used in robotic coding activities have short lifespans and wear out over time, that materials with different properties are needed for each project work, and that the inability to provide materials due to the uneconomical nature of the materials hinders the progress of related studies in this field. Fatsa and Turan (2022) concluded that educational robotics sets are costly in terms of the conditions in Turkey and that the product range is limited. In the study conducted by Aksu (2019), teachers' opinions are that robotic coding materials are costly and there are not enough materials in the classrooms.

From interviews with administrators, it can be concluded that there is a problem with robotic coding workshops in schools. Dikbaş and Polat (2022) conducted a study with school administrators regarding the establishment of robotic coding workshops in schools. As a result of this study, school administrators stated that the location designated for the coding workshop has infrastructure problems during the establishment of the workshop, the area where the workshop is established is not physically appropriate for the standards, and the installation of the workshop is costly. Öz Yıldız et al. (2020) studied the opinions of teachers using electronic and robotic coding applications and emphasised the importance of the provision of technical infrastructure, laboratory and basic materials by the Directorates of National Education. YEĞİTEK (2019b) also suggested that schools should be given the necessary support for the materials needed for these activities.

The quantitative data from the study indicated that teachers' opinions regarding the measurement-evaluation dimension of RCC were undecided. However, the data also revealed that teachers agreed that the measurement-evaluation techniques proposed in the curriculum are appropriate for measuring the objectives, that thepractice activities are clear and understandable, and that the time allotted for the course is appropriate. In the course of qualitative analysis, teachers indicated that they conducted assessment and evaluation in the form of practice exams. Two teachers indicated that they were able to carry out the practice activities in a physical setting, while eight teachers stated that they conducted the practice activities with a simulation program. The administrators also reported that they carried out the measurement and evaluation activities practically through the simulation program, which aligns with the teachers' perspectives. Eğin and Arıkan (2020) concluded that teachers utilized practice exams, projects, and product files as assessment and evaluation types in coding instruction.

The quantitative findings of the study indicate that approximately 50% of the teachers had received in-service training on robotic coding prior to the practice of RCC. The study, entitled 'Opinions of Information Technologies Teachers on In-Service Training Courses', conducted by Arslan and Şahin (2013), revealed that Information Technologies teachers place the greatest importance on the content of the course, its impact on their professional development and the location where the course is delivered. In their 2019 research, YEĞİTEK (2019b) evaluated coding education. They recommended that in-service training for ICT teachers should be scheduled on a regular basis and that coding education should be incorporated into the scope of support and training courses.

The findings indicated that the majority of teachers identified the lack, obsolescence, absence and inadequacy of tools, equipment and materials for the robotic coding course as the most significant challenge. The results of the student questionnaire indicated that the students' views on whether RCC is an adequate representation of the programming logic were largely positive. As Ersoy, Madran and Gülbahar (2011) have observed, Arduino and similar robotic coding programmes offer an important solution to the difficulties encountered when working with abstract concepts in programming language learning. The ability of students to see and observe the operation of the codes they write in the physical environment enables them to concretise the concepts related to programming. In terms of the quantitative aspects of the research, it can be seen that the students hold a positive view of the robotic coding course, believing that it helps them to consolidate their programming knowledge and to grasp the programming process more effectively. Almost half of the students surveyed indicated that they felt inadequate within the scope of the robotic coding course. The students identified algorithm creation and programming, electronic circuit setup/design (recognising circuit elements, making connections), and electronic knowledge (resistance, current, voltage, etc.) as the areas in which they felt the least confident. Talan (2020) conducted a systematic review of the scientific literature on educational robotics applications published between 2010 and 2019. The review identified the following as the most common challenges encountered in educational robotics coding: difficulty in establishing circuits, complexity and difficulty of the application, connection problems, inability to find appropriate code blocks, cost, and problems in classroom management. The statement, "The circuits were complicated, so the cables were interfering with each other and sometimes we were connecting them incorrectly. The point at which I encountered the greatest difficulty was connecting the circuits and cables to each other," can be considered a reference point.

From the data obtained from the teacher questionnaires, it can be seen that the teachers are undecided about the fact that 4 lessons are sufficient for the acquisition of the knowledge and skills in the content and that the class sizes are appropriate for the individual support of the pupils during thepractice activities, that they do not agree with the fact that the practice materials are easily accessible and inexpensive. It was also found that thepractice activities were carried out in the form of group work due to overcrowded classes. Cantarini and Polenta (2021) concluded that in robotics applications, students acquire social skills such as team building, problem solving, leadership and peer cooperation through group work. In his study, Kök (2019) observed that students received robotics education in groups and that students achieved more success in the lesson with group work.

More than half of the teachers interviewed and almost half of the administrators stated that the objectives could not be achieved. In the light of all these data, it can be stated that the objectives of the curriculum could not be fully realised due to the large class sizes, the inadequacy of the materials in the schools, the cost and inaccessibility of these materials if they were to be provided, and that there may be differences between the official RCC and the RCC in practice.

This research is limited to the curriculum, the assessment model and the participants involved in the research. Accordingly, the results obtained are unique to these institutions. The results should be interpreted with the understanding that this situation imposes certain limitations on the research. The findings from this study will shed light on the findings from similar studies to be conducted with other participants and in other regions, and will support the understanding of whether similar situations are experienced. Based on this, the recommendations from this study are as follows: In order for RCC to be more effective in practice, to eliminate the shortcomings in the functioning of the curriculum and to ensure the continuity of its strengths, it is necessary to re-analyse the needs of the system and to conduct further studies in this area. New studies can be conducted on other courses in VTE with different sample groups, different evaluation models and approaches. New studies can draw attention to the importance and need for the Robotic Coding course. Information on the functioning of the Robot Coding course, especially in industrial cities, can be obtained. The contribution of robotic coding education to other subject courses (object programming, mobile programming, etc.) and its impact on students' academic success can be studied. In vocational education, studies can be conducted on robotics kits (Arduino, Raspberry Pi, etc.) that are preferred in the robotics coding course.

It is anticipated that the findings of this research will inform the curriculum development initiatives undertaken by the relevant units of the MoNE, specifically in terms of evaluating the efficacy of the updated information technology curriculum. The efficacy of the VET 10th grade robotics coding course, which provides instruction in computer programming, has yet to be evaluated. It is imperative that the efficacy of the 10th grade robotics coding curriculum be determined, as this is a crucial aspect of the existing literature.

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