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High School Students' Use of Information, Media, and Technology Skills and Multidimensional 21st-Century Skills: An Investigation within the Context of Students, Teachers, and Curricula

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Abstract: The aim of this study is to determine high school students' information, media, and technology skills and their level of use of multidimensional 21st-century skills. A mixed quantitative and qualitative method was preferred in the study conducted in Northern Cyprus. Quantitative data were obtained from 612 senior high school students, and qualitative data were obtained from teachers and three different curricula. Face-to-face interviews were conducted with 10 teachers in order to determine the in-class activities that teachers carried out to provide information, media, and technology skills. The degree to which the Turkish language and literature, English, and mathematics curricula, which are among the basic courses offered in the senior year of high school, have outcomes for gaining information, media, and technology skills was determined through document analysis. The results obtained from the study revealed that the students' use of information, media, and technology skills was generally moderate. The students' use of programming skills, which are among the sub-dimensions of information, media, and technology skills as well as their problem-solving skills, were found to be very inadequate. Students' use of information and data literacy, communication, and collaboration skills, which are among the sub-dimensions of information, media, and technology skills, were found to be adequate. Similarly, it was concluded that the students' use of multidimensional 21st-century skills was also adequate. The results revealed that the classroom activities implemented by the teachers were insufficient in developing students' problem-solving skills in particular. Moreover, the results obtained with respect to curricula revealed that the mathematics curriculum had the highest number of outcomes related to information, media, and technology skills. The Turkish language and literature curriculum had the least number of outcomes related to information, media, and technology skills. The results of the research also revealed that the learning outcomes in the curricula were mostly related to communication and collaboration skills. The skill with the lowest number of related outcomes was found to be problem-solving.

Keywords: 21st century skills; information; media and technology competencies; student competencies; teacher competencies

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1. Introduction

Developments in the field of technology are impacting information societies, occupational fields are changing and developing, and the human profile needed in societies is being shaped accordingly. As the way people perform tasks relates to their environment changes, societies are being transformed into interconnected digitalized information societies [1]. In the 21st century, where knowledge is regarded as power, the need for

individuals who can distinguish what is necessary from complex information structures, synthesize information, have developed empathy and intuition, and have cultural, social, intellectual, and political identities is increasing [2]. Modern workplaces require employees to have cognitive and affective skills and expect individuals to have the ability to resolve complex problems, think critically about tasks, communicate effectively with people from different cultures, work collaboratively, and use different techniques [3]. Chiruguru [4] argued that labor skills and demands have changed dramatically over the last 20 years due to the rapid increase in jobs involving non-routine, analytical, and interactive communication skills. The 21st century, which has brought changes to people's lives in multiple areas, including economics, production, communication, and learning, has increased the complexity and challenges in life. In this context, it is seen as a requirement for individuals to have new skills, which are defined as 21st-century skills [5].

The literature emphasizes that 21st-century skills, which are critical for equipping learners for success in an increasingly competitive global market, should be placed at the center of learning [6,7], and it is recommended that students should be equipped with 21st-century skills in order to keep up with developments in the field of information and technology [8]. Developing students' skills requires content-rich educational programs, well-supported teachers, and improved evaluation methods [9]. For students to achieve high performance and acquire life skills, such as communication, intercultural cooperation, and critical thinking, teachers are expected to possess these skills and be trained in this direction [10,11]. In 21st-century classrooms, the role of teachers has shifted from that of expertise to facilitation, and the focus of teaching has changed to the ability to use and apply knowledge in meaningful ways [12]. In this context, teachers are expected to update their competency profiles according to 21st-century challenges and modify their teaching strategies to empower 21st-century learners [13]. Similarly, Santos [14] drew attention to the need for teachers to consider 21st-century learning skills in order to improve their classroom practices, while Mukombe and Gaotlhobogwe [1] referred to the need to incorporate 21st-century skills into school curricula. To help integrate 21st-century skills into the teaching of core academic subjects, the Partnership for 21st-Century Learning [15] has developed a unified, collective vision of learning known as the "Framework for 21st-Century Learning", which identifies the skills, knowledge, and competencies that will enable students to succeed in their future careers and lives. This partnership, which is a pioneer in terms of the inclusion of 21st-century skills in education, represents the 21st-century student outcomes in three frameworks, namely "Life and Career Skills", "Learning and Innovation Skills", "Information, Media, and Technology Skills", as well as five critical support systems to ensure that students gain learning experiences that constitute 21st-century competence, namely "21st-Century Standards", "Assessments of 21st-Century Skills", "21st-Century Curriculum and Instruction", "21st-Century Professional Development", and "21st-Century Learning Environments" [16].

Through the Partnership for 21st-Century Skills framework, students are more engaged in the learning process and are better prepared as graduates (Partnership for 21st-Century Learning) [15]. All components of the framework are critical for ensuring that students are ready for the 21st century. Key subjects and 21st-century themes include: "English, reading, language arts, world languages, arts, mathematics, economics, science, geography, history, government, and civics", while the significance of global awareness, financial, economic, business, and entrepreneurial literacy, civic literacy, health literacy, and environmental literacy is also highlighted [16]. Learning and innovation, which includes the components of "Creativity and Innovation, Critical Thinking, and Problem-Solving, Communication, and Collaboration", enables students to prepare for the complex living and working environments of the 21st century. Life and career skills, with the dimensions of "Flexibility and Adaptability, Initiative and Self-Direction, Social and Cross-Cultural Skills, Productivity and Accountability, Leadership and Responsibility", aim to develop students' thinking skills, content knowledge, and social and emotional competencies in complex living and working environments. With the accelerated technological develop-

ments, information, media, and technology skills, which include competencies, such as "Information Literacy, Media Literacy, Information, Communications, and Technology Literacy", constitute an important dimension of the framework [16]. Information, media, and technology skills, which have become important life skills over time, provide students with the power to develop thinking, learning, communication, collaboration, and production skills [17]. Kennedy and Sundberg [6] stated that one of the most important needs specific to the 21st century is to prepare students for the digital age, while Ünlü [18] alluded to the difficulties individuals experience with coping with the mass of unstructured information obtained from sources, such as web server logs, internet statistics, social media posts, blogs, and microblogs. Kivunja [19] noted that learners are now confronted with various media sources in all aspects of their lives and highlighted the need to teach students how to use information, media, and digital technologies. In this regard, it has become necessary and important for students to possess 21st-century skills, and it is seen as a requirement that education programs should be developed to include 21st-century skills, and teachers should be competent in using these skills. In this context, this study aimed to determine students' levels of use of information, media, and technology and 21st-century skills. In order to realize this aim, answers to the following questions were sought:

1. What is the level of students' use of information, media, and technology skills?
2. What is the level of students' use of multidimensional 21st-century skills?
3. What are the activities carried out by teachers to improve students' problem-solving skills?
4. To what extent do education programs cover outcomes related to information, media, and technology skills?

Theoretical Background

Technological developments and changes, as well as global challenges, such as the COVID-19 pandemic, have affected education systems, and it is only possible for students to adapt to these challenges and changes by acquiring 21st-century skills [20,21]. Twenty-first-century skills, which are defined as the skills that will enable students to succeed in their future careers, have been addressed by many organizations such as the Partnership for 21st-Century Skills (P21), Organization for Economic Cooperation and Development (OECD), International Society for Technology in Education National Educational Technology Standards (ISTE), The North Central Regional Educational Laboratory (NCREL), Assessment and Teaching of 21st-Century Skills (ATC21S) and European Parliament and Council, and many reports and frameworks have been developed to define these skills [22–24]. Twenty-first-century skills, which first emerged in 2006 as part of an OECD project, focus on 21st-century attributes and how individuals can acquire them [25].

Referring to the importance of providing students with 21st-century skills in the process of becoming an information society, Seferoğlu [26] defined these skills as critical thinking, problem-solving, communication, collaboration, information and communication technologies literacy, computational thinking, coding, and programming. Examining 21st-century skills from a broader perspective, Koşer [27] defined these skills as "critical thinking, problem-solving, inquiry, access to information, analysis and synthesis, communication, innovation, creativity, curiosity, imagination, decision-making, universal citizenship, intercultural interaction and communication, entrepreneurship, productivity, responsibility, and leadership". Defining 21st-century skills as the learning skills that students need in the new millennium, Ismail et al. [28] stated that in order for students to possess 21st-century skills, teachers need to master different fields, follow the latest approaches and teaching methods, and develop professional knowledge and skills. Not only teachers but also school systems and curricula are of great importance for students to acquire 21st-century skills. School systems should develop frameworks that emphasize the development of the skills, knowledge, and attitudes necessary for success in the 21st century [29], and curriculum outcomes, content, learning environments, assessment, and evaluation activities should be designed to meet 21st-century needs. Perdue [30] stated that many 21st-century skills advocates argue that traditional education systems are disconnected from modern edu-

cation, and therefore, students are unable to cope with challenges in both their personal and careers. In a similar line, Shields and Chugh [31] stated that schools should prepare students for the 21st century and emphasized that developing the knowledge and skills necessary for students is among the main responsibilities of schools. In particular, the need to specialize in 21st-century skills requires schools to develop students' 21st-century competencies, and curricula should be developed to meet these needs [32]. According to this necessity, schools in the northern part of Cyprus, as in the rest of the world, should develop frameworks to provide students with the necessary 21st-century skills, and traditional and subject-based curriculum designs should be replaced by contemporary curricula that include 21st-century competencies.

2. Materials and Methods

This section includes information on the research design, sample group, data collection tools, data collection, and analysis.

2.1. Research Design

The study was designed with a mixed methodology in which qualitative and quantitative approaches were employed together. Creswell [33] stated that the mixed method is an inquiry approach that involves the collection of both quantitative and qualitative data in a study, integrating the two forms of data, and using different designs to cover philosophical assumptions and theoretical frameworks. In this study, quantitative and qualitative data from students, teachers, and educational programs were collected simultaneously, analyzed independently, and compared and combined to determine students' levels of use of information, media, and technology skills as well as their multidimensional 21st-century skills. A simultaneous triangulation mixed method design was preferred since a complete identification of the problem situation was targeted, while qualitative data were obtained through the interview technique and document review method, and scales were used to collect quantitative data.

2.2. Participants

In this study, three different study groups were included in the research. Study groups are given in Figure 1.

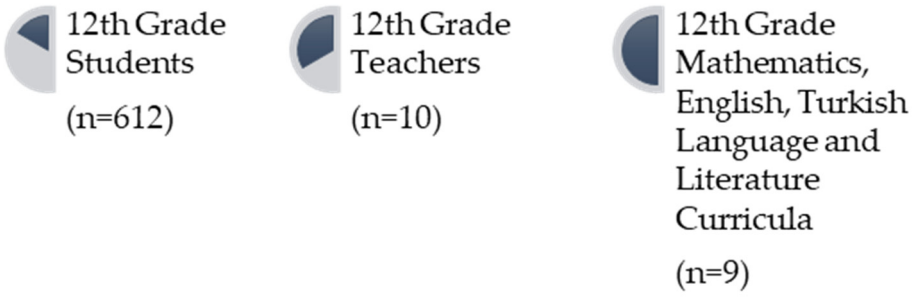


Figure 1. Study Groups.

2.2.1. Student Study Group

The first study group of the research comprised senior high school students. The population of the study consisted of 12th-grade students attending a total of 19 public schools in 6 different districts across the northern part of Cyprus under the Ministry of National Education (n = 2019). However, since it was not possible to reach the entire population due to time and cost constraints, the stratified sampling method was preferred in the study. The student sample was taken from a total of 2019 students aged 19 who were studying in the final year of high school (12th grade) in the northern part of Cyprus through the stratified sampling method. In this context, in the sample group of the study, 58.62% were from Lefka district, 58.39% from Trikomo district, 40.08% from Kyrenia district, 34.46% from Morphou district, 26.86% from Nicosia district and 19.31% from Famagusta

district (n = 612). Students were selected on a voluntary basis. The target sampling rate determined for the students constituting the population of this study was calculated as 30.31%.

Of the students participating in the study, 379 (61.9%) were female, and 233 (38.1%) were male. A total of 367 (60%) students had taken the "computer and communication technologies" course, while 245 (40%) of the students who participated in the study had never taken this course. According to the analysis of the student distribution by department, a total of 261 of the students were studying in the field of Science, 137 in the field of Turkish-Mathematics, 122 in the field of Social Sciences, 40 in the field of Foreign Languages, 23 in the field of Science (English language), and 29 in the field of Art. The study also identified the students' ownership of digital devices. A total of 277 students (45.3%) owned both a computer and a smartphone, while 174 students (28.4%) had three different devices, including a computer, tablet, and smartphone. While 136 students (22.2%) only had a smartphone, 20 students (3.3%) had both a tablet and a smartphone, and 5 students (0.8%) only had a computer. The findings reveal that the majority of the students who participated in the study owned more than one digital device.

2.2.2. Teacher Study Group

The second study group of the research consisted of high school teachers. Ten teachers were selected using the criterion sampling method in order to determine the activities carried out by teachers to provide information, media, and technology skills in the teaching process. The classroom activities of the teachers were analyzed in depth with a predefined list of criteria. Based on the principle of volunteerism, teachers from three different schools participated in the study. In addition to the criteria of voluntary participation, the fields in which the teachers specialized were also considered an important factor in the selection process. Teachers from the English, Mathematics, and Turkish Language and Literature fields were consulted for their views. The study group consisted of four Turkish Language and Literature teachers, three Mathematics teachers, and three English teachers. The teachers' professional seniority was distributed as 1–5 years (n = 3), 6–10 years (n = 1), 11–15 years (n = 4), 20–25 years (n = 1), and 26–30 years (n = 1). In addition, while five of the teachers had participated in in-service training on digital tools and software, the other five stated that they had not received any training. The study also revealed that the teachers who received training participated in courses, such as "using smart boards in classroom activities" and "teaching online". The digital tools most preferred in classroom activities by the teachers who were interviewed were revealed to be computers (n = 10), smart boards (n = 8), smartphones (n = 7), tablets (n = 5), laptops (n = 2), projectors (n = 2), and digital cameras (n = 2).

2.2.3. Document Analysis

In order to determine the outcomes related to information, media, and technology skills in the 12th-grade Turkish Language and Literature, English, and Mathematics curricula, the document analysis method was employed. The study was limited to the 12th-grade high school Turkish Language and Literature, English, and Mathematics curricula. The main reason for choosing these curricula was that these courses are obligatory and basic courses at the high school level. The document analysis was conducted with a total of nine teachers, comprised of three Turkish Language and Literature, three Mathematics, and three English teachers, who were working at the high school level in the Ministry of National Education and who voluntarily agreed to participate in the study. One of the main reasons why teachers were included in the study was that they implemented the curricula in their classrooms. The professional seniority of the third study group formed for document analysis was distributed between 1–5 years (n = 3), 6–10 years (n = 1), 11–15 years (n = 3), and 20–30 years (n = 2).

2.3. Data Collection Tools

The quantitative and qualitative data necessary to determine the students' level of use of information, media, and technology and the multidimensional 21st-century skills were obtained using four different data collection tools.

2.3.1. Information, Media, and Technology Skills Competency Scale

The "information, media, and technology skills competency scale" developed by Hazar [34] was employed to determine the level of students' use of information, media, and technology skills. The scale developed to measure middle and high school students' competencies of information, media, and technology skills consists of 6 sub-dimensions and a total of 23 items. The sub-dimensions of the 5-point Likert-type scale are titled "Communication and Collaboration", "Programming", "Problem-Solving", "Digital Content Development", "Information and Data Literacy" and "Security". The scale is scored from 5 "always" to 1 "never". As the scores obtained from the scale approach 5, it can be concluded that the level of students' use of information, media, and technology skills increases in a positive direction. The Cronbach's alpha coefficient of the scale was calculated as 0.891. The obtained value reveals that the reliability of the scale is high.

2.3.2. Multidimensional 21st-Century Skills Scale

In order to determine the level of students' use of 21st-century skills, the "multidimensional 21st-century skills scale" developed by Cevik and Senturk [35] was employed. The scale developed for adolescent and early adulthood students between the ages of 15–25 consists of 5 sub-dimensions and 41 items. The 5-point Likert-type scale is graded from 5 "completely agree" to 1 "completely disagree". It can be concluded that as the scores obtained from the scale approach 5, the level of students' use of 21st-century skills increases favorably. The sub-dimensions in the scale are titled "Information and Technology Literacy Skills", "Critical Thinking and Problem-Solving Skills", "Entrepreneurship and Innovation Skills", "Social Responsibility and Leadership Skills", "Career Consciousness" respectively. The Cronbach's alpha coefficient of the scale was calculated as 0.918, and it was determined that the reliability of the scale was high.

2.3.3. Teacher Interview Form

An interview form consisting of open-ended questions, prepared by Hazar [34] based on expert opinions in the light of the European Commission Digital Competence Framework data, was employed to determine the activities carried out by teachers in learning-teaching processes related to information, media, and technology skills. The form particularly focused on the activities that teachers carried out to improve students' problem-solving skills.

2.3.4. Document Analysis Form

In the study, a structured document analysis form prepared by Hazar [34] based on the data of the European Commission Digital Competence Framework, was employed to determine the rate of outcomes related to information, media, and technology skills in the 12th-grade Turkish Language and Literature, Mathematics and English curricula. Through the document analysis form, a total of 21 outcomes covering 5 skill dimensions and sub-dimensions and criteria related to these skills were examined within the framework of the Turkish Language and Literature, Mathematics, and English curricula.

2.4. Data Collection and Procedure

The process of data collection in the study was initiated by the researchers contacting the Ministry of National Education and obtaining the necessary permissions to administer the instruments to both students and teachers. Once the relevant permission and approval had been granted, the principals of a total of 19 high schools operating in 6 different districts of Northern Cyprus were contacted, and information about the study was provided to them. The researchers visited the schools on the days and times determined as a result

of the interviews with the school principals and provided information about the aim and significance of the study to teachers and senior high school students during a period of approximately 20 min. Qualitative data were collected from two different groups of teachers, while quantitative data were collected from 12th-grade students. Ethical processes were meticulously carried out in the research such that the personal information of students and teachers was kept confidential. Data were collected after the students were informed about the data collection tools. The application of the data collection tools to the student groups took approximately 30 min.

Face-to-face interviews were conducted with Turkish Language and Literature, Mathematics, and English teachers in order to determine the activities carried out by teachers in learning-teaching processes related to information, media, and technology skills. After obtaining the necessary permission from the teachers (n = 10) who voluntarily agreed to participate in the study, all interviews were recorded with a voice recorder. Another group of teachers (n = 9) was interviewed to determine the ratio of outcomes related to information, media, and technology skills in the Mathematics, Turkish Language and Literature, and English curricula. Three teachers from each discipline were selected on the basis of volunteerism and answered the document review forms in order to analyze the program they were implementing. A one-week period was provided for each teacher, after which the teachers were contacted again and the forms they completed were collected.

2.5. Data Analysis

Quantitative data obtained from the scales employed to determine the students' levels of use of information, media, and technology and multidimensional 21st-century skills were analyzed using the SPSS package program. Quantitative data were analysed using descriptive statistics, one of the types of statistical analysis. The quantitative data obtained from the first sub-objective of the study, "What is the level of students' use of information, media and technology skills?", were analyzed by calculating the percentage, frequency, arithmetic mean, and standard deviation values. Similarly, the quantitative data obtained from the second question of the study, "What is the level of students' use of multidimensional 21st-century skills?", were analyzed by calculating percentage, frequency, arithmetic mean, and standard deviation values. The arithmetic mean scores obtained from the information, media, and technology skills scale and the multidimensional 21st-century skills scale were interpreted as 1.00–1.80 "Very inadequate", 1.81–2.60 "Inadequate", 2.61–3.40 "Moderate", 3.41–4.20 "Adequate", and 4.21–5.00 "Very adequate".

For the third sub-objective of the study, semi-structured interviews were conducted to determine the activities carried out by teachers to develop students' problem-solving skills. The audio recordings of the face-to-face interviews with the teachers were transcribed in full for each teacher individually and converted into a qualitative data file. The responses obtained to determine the teaching activities carried out by the teachers in the classroom for information, media, and technology skills were analyzed using the content analysis technique. The transcribed voice recordings were analyzed in depth by the researchers to determine the common threads of the responses. In addition, the qualitative data obtained following the teacher interviews were further confirmed by the participants. The validity of the data was ensured by including one-to-one teacher opinions in the tables where qualitative data were interpreted. In addition, Miles and Huberman's [36] qualitative data analysis model was used for the validity and reliability analysis of the themes obtained from the qualitative data. Field experts (n = 2) were asked for their opinions on the relevance of the themes. The reliability rate of the qualitative data was determined to be 100% using the formula [reliability $\geq$ [consensus/(consensus + disagreement)]].

In order to achieve the fourth sub-objective of the research, which is to determine the extent to which the curriculum covered the outcomes related to information, media, and technology skills, document analysis was carried out. The data obtained from the teachers who provided views on the extent to which the curriculum they implemented covered information, media, and technology skills using the document review forms were

divided into categories and criteria. Initially, it was analyzed whether the curriculum included learning outcomes related to information, media, and technology skills. Then, by examining the document review form information, media, and technology skills sub-dimension categories and criteria, the related outcomes in the curricula were compared. The presence of the learning outcomes in the program was coded as x or √ using the "present" or "not present" technique. The coded skills were coded by giving "√" a value of "1" according to the presence of the categorized skills in the examined program and "x" a value of "0" if they were absent. The coding was computed in the SPSS package program, and the arithmetic averages and frequencies of the criteria belonging to the sub-dimensions of the skills between the three coders were examined. If the document review form criterion responses of each teacher were above the average, it was accepted that the skill was present in the relevant category.

3. Results

The findings obtained from quantitative and qualitative data in the study are presented below in line with the main objectives and sub-objectives of the study.

3.1. Findings on Students' Levels of Use of Information, Media, and Technology Skills

In the study, the "information, media and technology skills competency scale" developed by Hazar [21] was employed to determine the level of students' use of information, media, and technology skills. Information, media, and technology skills were examined by considering the sub-dimensions of "Programming", "Problem-Solving", "Security", "Digital Content Development", "Communication and Collaboration", and "Information and Data Literacy". The average scores obtained from the scale are presented in Table 1.

Table 1. Arithmetic Mean and Standard Deviation Score Distributions of the Level of Students' Use of Information, Media, and Technology Skills.

Dimensions	n	M	Sd
Programming	612	1.62	0.843
Problem-Solving	612	2.44	1.095
Security	612	3.13	1.232
Digital Content Development	612	3.47	1.225
Communication and Collaboration	612	3.92	0.760
Information and Data Literacy	612	3.95	0.917
Total score	612	3.11	0.660

When the scores obtained from the information, media, and technology skills competency scale are analyzed, it is revealed that the highest score students obtained from the scale is related to the "Information and Data Literacy" dimension. Students expressed their level of using information and data literacy skills as "adequate" (M = 3.95, sd = 0.917). Through information and data literacy skills, students are expected to have knowledge of the ways of accessing information and to be able to select search engines and databases for this purpose. In addition, students are expected to have the skills, such as considering the reliability of information shared on the internet, being aware of the purpose of digital content, taking into account copyrights and laws in sharing content and evaluating the reliability of information accessed on the internet. The findings reveal that the students' level of using these skills is adequate. "Communication and Collaboration" (m = 3.92, sd = 0.760) and "Digital Content Development" (M = 3.47, sd = 1.225) were the other skills in which students felt competent. As presented in Table 1, students rated their use of "Security" skills as "moderate" and do not feel fully competent in this respect. The skills in which students felt inadequate were "Programming" (M = 1.62, sd = 0.843) and "Problem-Solving" (M = 2.44, sd = 1.095). When the total scores obtained from the overall scale were analyzed, it was seen that students' competencies with respect to information, media, and technology skills were at a moderate level (M = 3.11, sd = 0.660). In this context,

it can be stated that there are deficiencies in students' competence levels regarding the use of information, media, and technology skills and that they need training in this direction.

In the study, a radar diagram was used to compare students' mean scores for "Programming, Problem-Solving, Security, Digital Content Development, Communication and Collaboration, Information, and Data Literacy" skills to indicate which skills have similar values and to show the variations between skills. Figure 2 presents the visualized results of the students' information, media, and technology skills.

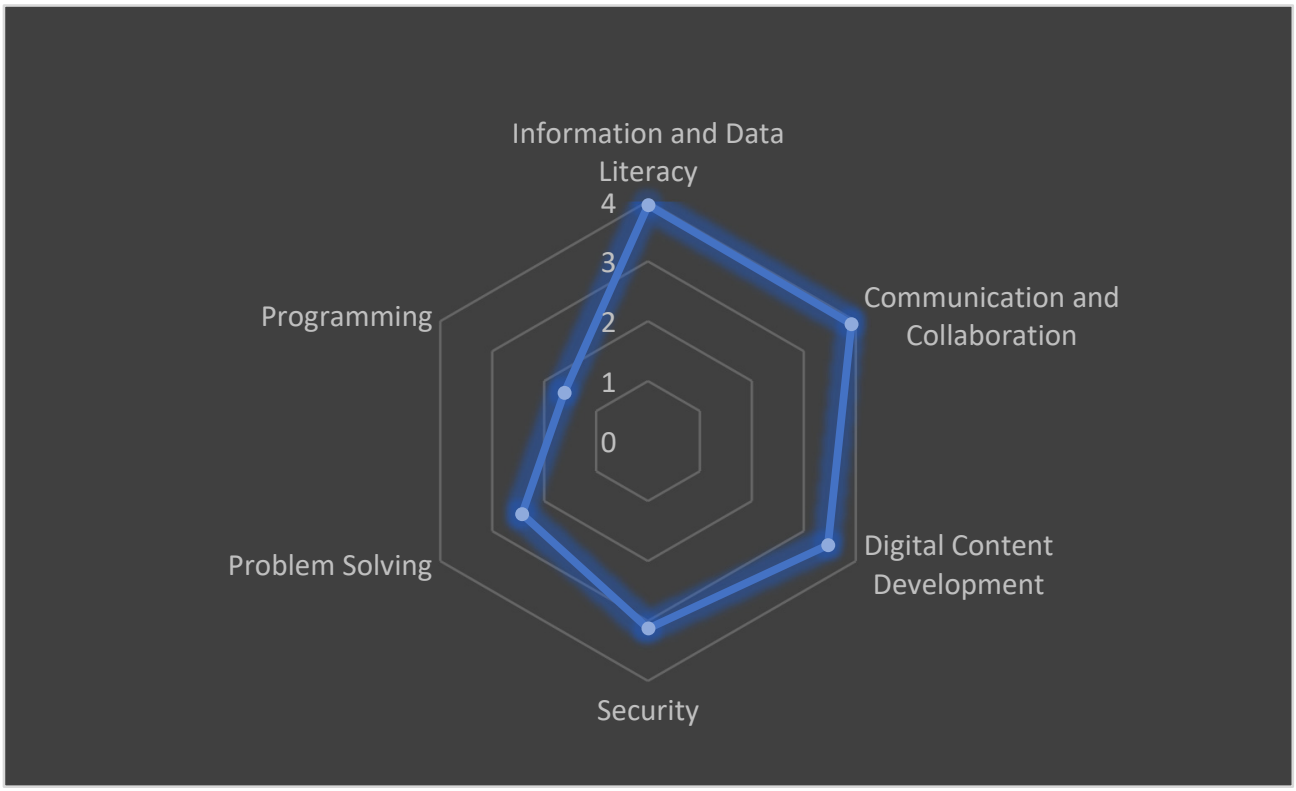


Figure 2. Radar Diagram of Students' Level of Use of Information, Media, and Technology Skills.

Figure 2 illustrates the visualized results of the arithmetic mean scores obtained from the six sub-dimensions of information, media, and technology skills. The outer ring in the radar diagram represents the highest score, and the inner ring represents the lowest score. In this context, it is clear that the skills with the highest level of use are "information and data literacy" and "communication and collaboration". Although the students' usage levels of "digital content development" and "security" skills are slightly lower, the skills with the lowest usage level and for which students need support are "programming" and "problem-solving". The results obtained reveal the importance of teachers placing emphasis on activities that can improve students' programming and problem-solving skills in classroom activities.

In the study, answers were also sought to the questions of whether students with inadequate problem-solving skills can solve hardware problems or whether they can cope with technical problems they encounter while using the internet. Furthermore, questions, such as "What is the level of Web site preparation skills of the students whose usage levels of programming skills are inadequate?" or "Can they find errors by testing an algorithm?" were also included. In this context, the frequency, arithmetic mean, and standard deviation values of the scale items related to information, media, and technology skills are presented in Table 2.

Table 2. Frequency, Arithmetic Mean, and Standard Deviation Score Distributions of Information, Media, and Technology Skills Scale Items.

Scale Items	**Never**		**Rarely**		**Partially**		**Mostly**		**Always**			
Items for Communication and Collaboration Dimension	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
1. Sharing various information and content (text, audio, video, image, etc.) on the internet	39	6.37	163	26.63	147	24.02	160	26.14	103	16.83	3.2	1.190
2 Making video and audio calls over the internet	11	1.8	64	10.46	105	17.16	208	33.99	224	36.6	3.93	1.056
3. Membership of social networks such as Facebook, Twitter etc.	20	3.27	39	6.37	61	9.97	206	33.66	286	46.73	4.14	1.048
4. Using instant messaging tools	5	0.82	19	3.1	42	6.86	169	27.61	377	61.6	4.46	0.819
5. Creating an e-mail account	21	3.43	97	15.85	90	14.71	138	22.55	266	43.46	3.87	1.229
Items for Programming Dimension												
6. Preparing a website using one of the web programming languages	400	65.36	92	15.03	79	12.91	22	3.59	19	3.1	1.64	1.038
7. Debugging an algorithm by testing it	398	65.03	87	14.22	89	14.54	22	3.59	16	2.61	1.65	1.025
8. Using at least one programming language effectively	440	71.9	91	14.87	47	7.68	20	3.27	14	2.29	1.49	0.936
9. Creating a web page or blog using ready-made templates	380	62.09	114	18.63	60	9.8	32	5.23	26	4.25	1.71	1.108
Items of Problem-Solving Dimension												
10. Solving simple hardware problems	319	52.12	112	18.3	80	13.07	56	9.15	45	7.35	2.01	1.297
11. Installing and uninstalling software on a computer	270	44.12	116	18.95	120	19.61	69	11.27	37	6.05	2.16	1.268
12. Getting online help to troubleshoot software and hardware problems	207	33.82	135	22.06	109	17.81	89	14.54	72	11.76	2.48	1.388
13. Solving technical problems that arise when using the internet	76	12.42	135	22.06	150	24.51	146	23.86	105	17.16	3.11	1.278
Items for Digital Content Development Dimension												
14. Creating documents in word processing programs	76	12.42	86	14.05	117	19.12	161	26.31	172	28.1	3.44	1.355
15. Preparing a presentation using presentation software	44	7.19	87	14.22	142	23.2	156	25.49	183	29.9	3.57	1.250
16. Adding pictures, tables, and graphics to a file in word processing programs	75	12.25	94	15.36	126	20.59	141	23.04	176	28.76	3.41	1.365
Information and data literacy												
17. Paying attention to the reliability of the information shared on the internet	21	3.43	39	6.37	68	11.11	194	31.7	290	47.39	4.13	1.064
18. Being aware of the purpose of digital content	31	5.07	37	6.05	64	10.46	197	32.19	283	46.24	4.08	1.122
19. Considering copyrights and laws when sharing content	70	11.44	65	10.62	101	16.5	168	27.45	208	33.99	3.62	1.348
20. Evaluating the reliability of the information accessed on the Internet	32	5.23	46	7.52	83	13.56	202	33.01	249	40.69	3.96	1.147
Items of Security Subdimension												
21. Installing anti-virus programs on digital devices	152	24.84	102	16.67	102	16.67	126	20.59	130	21.24	2.97	1.489
22. Using a firewall to protect against security attacks from the internet	123	20.1	86	14.05	117	19.12	134	21.9	152	24.84	3.17	1.460
23. Configuring security settings for digital devices	106	17.32	82	13.4	131	21.41	135	22.06	158	25.82	3.26	1.420
Information Media and Technology Skills Total	3316	23.56	1988	14.12	2230	15.84	2951	20.97	3591	25.51	3.11	0.660

As Table 2 reveals, 71.9% of the students could not use programming languages effectively. In addition, 65.36% of them had never prepared a website using one of the Web programming languages, which is among the programming skills. Likewise, 65.03% of the students had not debugged an algorithm by testing it. Moreover, 62.09% of the students who participated in the research also stated that they could not prepare a web page or blog using ready-made templates. The findings obtained reveal that the level of students' use of programming skills is relatively inadequate.

Another skill in which the students perceived themselves to be inadequate is the ability to solve simple hardware problems. In fact, 52.12% of the students stated that they particularly needed training in solving hardware problems. In this context, it is suggested that curricula should include learning outcomes that will improve students' programming and problem-solving skills.

3.2. Findings on Students' Level of Use of Multidimensional 21st-Century Skills

The "multidimensional 21st-century skills scale" developed by Cevik and Senturk [35] was used to determine the level of students' use of 21st-century skills. Students' levels of use of 21st-century skills were examined in five sub-dimensions, and mean scores were obtained for each dimension. The findings obtained from the scale are presented in Table 3.

Table 3. Arithmetic Mean and Standard Deviation Score Distributions of Students' Levels of Use of Multidimensional 21st-Century Skills.

Dimensions	n	M	Sd
Entrepreneurship and innovation skills	612	3.50	0.688
Social responsibility and leadership skills	612	3.75	0.641
Critical thinking and problem-solving skills	612	3.84	0.714
Knowledge and technology literacy skills	612	4.09	0.548
Career consciousness	612	4.43	0.610
Total score	612	3.93	0.460

When the students' level of use of 21st-century skills was examined, it was revealed that they perceived themselves to be most adequate in "Career consciousness" skills (M = 4.43, sd = 0.610). Similarly, it was determined that the students who participated in the study perceived themselves to be adequate in "Knowledge and technology literacy" (M = 4.09, sd = 0.548), "Critical thinking and problem-solving" (M = 3.84, sd = 0.714), "Social responsibility and leadership" (M = 3.75, sd = 0.641) and "Entrepreneurship and innovation" (M = 3.50, sd = 0.688) skills. The findings reveal that the students do not require any training on the use of multidimensional 21st-century skills.

The visualized results of the students' level of use of multidimensional 21st-century skills are presented in Figure 3.

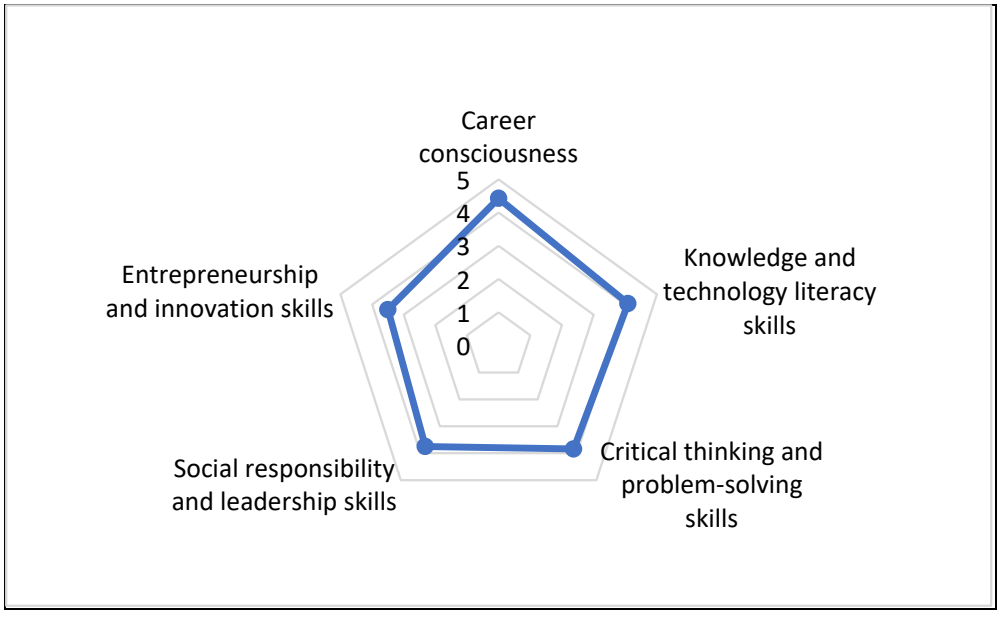


Figure 3. Radar Diagram of Students' Levels of Use of Multidimensional 21st-Century Skills.

Figure 3 shows that the mean scores of the students for the sub-dimensions of 21st-century skills were similar to each other. The arithmetic mean scores of all five skills in the radar diagram are close to 5, and this result reveals that the students' level of use of multidimensional 21st-century skills is high. The arithmetic mean, frequency, and standard deviation values of the multidimensional 21st-century skills scale items are presented in Table 4.

Table 4. Frequency, Arithmetic Mean and Standard Deviation Score Distributions of Multidimensional 21st-Century Skills Scale Items.

	Multidimensional 21st-Century Skills Scale Items	**Completely Disagree**		**Disagree**		**No Opinion**		**Agree**		**Completely Agree**			
	Knowledge and technology literacy skills	*f*	%	*f*	%	*f*	%	*F*	%	*f*	%	M	SD
1	I am curious about learning.	7	1.1	4	0.7	27	4.4	275	44.9	299	48.9	4.40	0.71
2	I like to listen to new and different ideas.	6	1.0	2	0.3	17	2.8	245	40.0	342	55.9	4.50	0.67
3	I try to acquire new information other than the existing information.	7	1.1	11	1.8	52	8.5	293	47.9	249	40.7	4.25	0.78
4	I follow the innovations in our country and in the world.	8	1.3	24	3.9	79	12.9	318	52.0	183	29.9	4.05	0.84
5	I have ideas about changes and innovations in the world.	7	1.1	30	4.9	117	19.1	320	52.3	138	22.5	3.90	0.84
6	I acquire different information and ideas by following various sources.	7	1.1	29	4.7	90	14.7	311	50.8	175	28.6	4.01	0.85
7	I like to obtain new information by doing research from reliable sources.	8	1.3	24	3.9	71	11.6	286	46.7	223	36.4	4.13	0.86
8	I realize what kind of information I need in daily life.	8	1.3	16	2.6	75	12.3	325	53.1	188	30.7	4.09	0.80
9	I access the information I need from the right sources.	8	1.3	7	1.1	75	12.3	309	50.5	213	34.8	4.16	0.78
10	I investigate the accuracy of the information I obtain from different sources.	7	1.1	36	5.9	66	10.8	288	47.1	215	35.1	4.09	0.89
11	I use the information that I have obtained and am sure of its accuracy effectively in my daily life.	8	1.3	19	3.1	65	10.6	313	51.1	207	33.8	4.13	0.82
12	I transfer the information whose accuracy I am certain about to the people around me.	9	1.5	14	2.3	48	7.8	279	45.6	262	42.8	4.26	0.81
13	I regularly follow written, audio and visual sources.	10	1.6	44	7.2	168	27.5	267	43.6	123	20.1	3.73	0.92
14	I know the meanings of the smart sign symbols indicating which audience a program addresses before TV programs.	25	4.1	57	9.3	144	23.5	190	31.0	196	32.0	3.78	1.12
15	I closely follow the developments in technology.	12	2.0	43	7.0	104	17.0	280	45.8	173	28.3	3.91	0.95
	Critical thinking and problem-solving skills	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
16	I believe that all the information I am told is true.	202	33.0	284	46.4	69	11.3	45	7.4	12	33.0	4.01	0.96
17	I do not want to be friends with people who do not think like me.	203	33.2	239	39.1	95	15.5	49	8.0	26	33.2	3.89	1.09
18	I do not like people who criticize me.	99	16.2	218	35.6	122	19.9	104	17.0	69	16.2	3.28	1.24
19	I accept that all information I read is correct.	246	40.2	267	43.6	53	8.7	33	5.4	13	40.2	4.14	0.94
20	I talk about the subjects I learn without thinking about them.	206	33.7	239	39.1	84	13.7	60	9.8	23	33.7	3.89	1.09
21	I ignore the problems I encounter instead of dealing with them.	197	32.2	241	39.4	85	13.9	58	9.5	31	32.2	3.84	1.13
	Entrepreneurship and innovation skills	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
22	I usually carry out my work with enthusiasm, eagerness, and energy.	19	3.1	58	9.5	140	22.9	286	46.7	109	17.8	3.67	0.98
23	I turn negative situations I encounter into opportunities.	24	3.9	84	13.7	192	31.4	229	37.4	83	13.6	3.43	1.01
24	I plan and manage time well.	41	6.7	105	17.2	145	23.7	218	35.6	103	16.8	3.39	1.15
25	I produce different products in my work.	21	3.4	50	8.2	212	34.6	235	38.4	94	15.4	3.54	0.96
26	I like dealing with complex and difficult tasks.	25	4.1	80	13.1	144	23.5	234	38.2	129	21.1	3.59	1.08
27	I observe and analyze everything with an intense sense of curiosity.	15	2.5	36	5.9	118	19.3	249	40.7	194	31.7	3.93	0.98
28	I think about methods and techniques that will make people's lives easier.	23	3.8	73	11.9	171	27.9	237	38.7	108	17.6	3.55	1.03

Table 4. *Cont.*

	Multidimensional 21st-Century Skills Scale Items	Completely Disagree		Disagree		No Opinion		Agree		Completely Agree			
29	I produce and implement unusual, new, and useful ideas.	20	3.3	80	13.1	204	33.3	220	35.9	88	14.4	3.45	1.00
30	I think about the needs that may arise in the world in the future and conduct research on these needs.	40	6.5	113	18.5	205	33.5	170	27.8	84	13.7	3.24	1.10
31	I can easily present the products I have developed to the people around me.	42	6.9	109	17.8	210	34.3	167	27.3	84	13.7	3.23	1.11
	Social responsibility and leadership skills	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
32	I try to communicate with people from different cultures.	12	2.0	47	7.7	81	13.2	243	39.7	229	37.4	4.03	1.00
33	In group work, I usually act as the leader of the group.	34	5.6	122	19.9	179	29.2	170	27.8	107	17.5	3.32	1.14
34	I contribute to the development of the skills of people around me as well as myself.	13	2.1	38	6.2	106	17.3	314	51.3	141	23.0	3.87	0.91
35	I think that group work is a waste of time.	174	28.4	250	40.8	113	18.5	44	7.2	31	5.1	3.80	1.08
	Career consciousness	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
36	I try to successfully complete tasks assigned to me.	4	0.7	6	1.0	28	4.6	199	32.5	375	61.3	4.53	0.69
37	I have decided about the career I want to have in the future.	20	3.3	24	3.9	85	13.9	180	29.4	303	49.5	4.18	1.03
38	I try to determine the most suitable profession for myself by researching the characteristics of professions.	10	1.6	17	2.8	53	8.7	201	32.8	331	54.1	4.35	0.87
39	I want to be successful in my future profession.	6	1.0	3	0.5	21	3.4	76	12.4	506	82.7	4.75	0.63
40	I am aware that the decisions I make at this stage of my life will shape my future.	8	1.3	7	1.1	32	5.2	155	25.3	410	67.0	4.56	0.76
41	I utilize opportunities that will contribute to my personal development and future career (internship, course, congress, seminar, training, etc.).	16	2.6	23	3.8	76	12.4	199	32.5	298	48.7	4.21	0.98
	Multidimensional 21st-century skills Total	735	2.9	1828	7.3	4221	16.8	10019	39.9	8289	33	3.93	0.46

Table 4 reveals that the students' level of use of multidimensional 21st-century skills is generally high. When the arithmetic mean scores obtained from the scale were analyzed, it was found that the statements with the highest arithmetic mean were "I want to be successful in my future profession" (M = 4.75, sd = 0.63), "I am aware that the decisions I make at this stage of my life will shape my future" (M = 4.56, sd = 0.76), and "I try to successfully complete tasks assigned to me" (M = 4.53, sd = 0.69). The findings reveal that the level of students' use of career consciousness skills is quite high.

3.3. Findings Related to the Activities Carried Out by Teachers to Improve Students' Problem-Solving Skills

In the study, the aim was also to determine the activities that teachers carried out to equip students with information, media, and technology skills. During face-to-face interviews with teachers (n = 10) from three different disciplines (Turkish Language and Literature, Mathematics, and English), the question "Do you encourage your students to use digital tools to develop problem-solving skills in learning-teaching activities?" was asked. The responses of the teachers are presented in Table 5.

As a result of the face-to-face interviews with 10 teachers from three different disciplines, it was determined that a total of 5 teachers utilized digital tools to improve students' problem-solving skills in learning-teaching activities. However, when Table 5 is analyzed, it is revealed that the activities carried out by the teachers were not adequate to develop students' problem-solving skills. The other teachers (n = 5) who expressed their views in the study stated that they did not use digital tools at all during learning-teaching activities. Teachers who do not use digital tools continue to use traditional methods for teaching activities and stated that the course content is not suitable for the use of digital tools. The fact that teachers prefer traditional methods to develop students' problem-solving skills is considered a deficiency.

Table 5. Qualitative Analysis Results of Classroom Activities Carried Out to Improve Students' Problem-Solving Skills.

Courses	Encouragement	Utilization of Digital Tools in Activities Related to Problem-Solving Skills
English		
Teacher 1	Yes	Students intervene and solve the problem if the video and audio do not turn on while watching a video in the English "Listening" class.
Teacher 2	No	Since the students are very tech-savvy, they can help with English lessons if needed.
Teacher 3	Yes	In English classes, when students sometimes encounter problems in shooting or sending a video or cutting the audio recording, the teacher provides hints for students to solve the problem.
Mathematics		
Teacher 4	No	In mathematics classes, mostly old methods and books are used, digital tools are not used much in the program, and it would be good if geometry could be shown on the smart board.
Teacher 5	No	We cannot use digital tools to solve problems in mathematics class.
Teacher 6	Yes	In mathematics, students are partly encouraged to solve problems that arise with computer hardware during the lesson. They are asked to listen to the topics they do not understand again through digital channels and solve questions.
Turkish Language and Literature		
Teacher 7	Yes	When using the smart board in Turkish Language and Literature classes, students help with pages that cannot be accessed or programs that do not launch.
Teacher 8	Yes	When individual private meetings were required in Zoom during the online Turkish Language and Literature class, students solved the problem by showing the teacher how to separate a room and move to a private room. In addition, students showed how to use the desktop when it was needed to draw. Students watch and learn from YouTube to solve problems.
Teacher 9	No	There are not many problems in the Turkish Language and Literature course.
Teacher 10	No	Students turn to their teachers when they encounter difficulties in Turkish Language and Literature lessons.

3.4. Findings Regarding the Extent Curricula Cover the Outcomes Related to Information, Media, and Technology Skills

In this study, in order to determine the extent to which the 12th-grade curricula include information, media and technology skills, the outcomes of the Turkish Language and Literature, English, and Mathematics curricula were examined. In the study in which three teachers from each discipline participated (n = 9), the teachers examined the programs for their own fields and tried to determine the level of coverage of the outcomes related to information, media, and technology skills in the programs. Qualitative data obtained from teachers' opinions were analyzed with the content analysis technique. Table 6 presents the distribution of learning outcomes related to information, media, and technology skills in the curricula.

Table 6. Distribution of Outcomes Related to Information, Media, and Technology Skills in Turkish Language and Literature, English, and Mathematics Curricula.

Information Media Technology Skills Sub-Dimensions	Turkish Language and Literature Learning Outcomes (n = 21)		English Learning Outcomes(n = 21)		Mathematics Learning Outcomes (n = 21)		Literature, English, and Mathematics Total Learning Outcomes (n = 63)	
	f	%	*f*	%	*f*	%	*f*	%
1. Information and Data Literacy	2	9.52	1	4.76	2	9.52	5	7.94
1.1. Filter, Search, and Browse Information, Data, and Digital Content	1	4.76	0	0	1	4.76	2	3.17
1.2. Evaluate Information, Data, and Digital Content	0	0	0	0	0	0	0	0.00
1.3. Manage Information, Data, and Digital Content	1	4.76	1	4.76	1	4.76	3	4.76
2. Communication and Collaboration	0	0	2	9.52	5	23.81	7	11.11
2.1. Interact Using Digital Technologies	0	0	1	4.76	1	4.76	2	3.17
2.2. Share Using Digital Technologies	0	0	1	4.76	1	4.76	2	3.17
2.3. Civic Engagement Using Digital Technologies	0	0	0	0	1	4.76	1	1.59
2.4. Collaborate Using Digital Technologies	0	0	0	0	1	4.76	1	1.59
2.5. Behave in accordance with Internet Ethics (Netiquette)	0	0	0	0	0	0	0	0.00
2.6 Manage Digital Identity	0	0	0	0	1	4.76	1	1.59
3. Production of Digital Content	0	0	1	4.76	2	9.52	3	4.76
3.1 Develop Digital Content	0	0	1	4.76	1	4.76	2	3.17
3.2 Integrate and Reorganize Digital Content	0	0	0	0	1	4.76	1	1.59
3.3 Copyrights and Licenses	0	0	0	0	0	0	0	0.00
3.4 Programming	0	0	0	0	0	0	0	0.00
4. Security	0	0	1	4.76	1	4.76	2	3.17
4.1. Protect Devices	0	0	1	4.76	0	0	1	1.59
4.2. Protect Personal Data and Privacy	0	0	0	0	1	4.76	1	1.59
4.3. Protect Health and Welfare	0	0	0	0	0	0	0	0.00
4.4. Protect Environment	0	0	0	0	0	0	0	0.00

Table 6. *Cont.*

Information Media Technology Skills Sub-Dimensions	Turkish Language and Literature Learning Outcomes (n = 21)		English Learning Outcomes(n = 21)		Mathematics Learning Outcomes (n = 21)		Literature, English, and Mathematics Total Learning Outcomes (n = 63)	
	f	%	*f*	%	*f*	%	*f*	%
5. Problem-Solving	0	0	0	0	0	0	0	0.00
5.1. Solve Technical Problems	0	0	0	0	0	0	0	0.00
5.2. Identify Needs and Technological Answers	0	0	0	0	0	0	0	0.00
5.3. Use Digital Technologies Creatively	0	0	0	0	0	0	0	0.00
5.4. Identify Digital Competence Gaps	0	0	0	0	0	0	0	0.00
Information Media Technology Skills Total Learning Outcomes	2	9.52	5	23.81	10	47.62	17	26.98

As a result of the document analysis conducted by nine teachers, it was determined that two outcomes in the 12th-grade Turkish Language and Literature curriculum, five outcomes in the English curriculum, and 10 outcomes in the mathematics curriculum were related to information, media, and technology skills.

It was revealed that the outcomes in the 12th-grade high school mathematics curriculum are in the information and data literacy dimension (n = 2), communication and collaboration dimension (n = 5), digital content production dimension (n = 2), and security dimension (n = 1), and there are no outcomes in the problem-solving dimension. It was determined that 10 (47.62%) of the 21 objectives related to information, media, and technology skills are included in the mathematics curriculum. Among the objectives in the 12th-grade high school English curriculum, there are objectives related to information, media, and technology skills in the information and data literacy dimension (n = 1), communication and collaboration dimension (n = 2), digital content production dimension (n = 1) and security dimension (n = 1), while there are no objectives in the problem-solving dimension. As a result of the document analysis, it was revealed that only five of the 21 outcomes (23.81%) are included in the English curriculum. When the outcomes related to information, media, and technology skills in the Turkish Language and Literature curriculum were examined, it was found that two of them are related to the information and data literacy dimension, and no outcomes are included in the program for communication and collaboration, digital content production, security, and problem-solving dimensions. In this context, only 9.52% of the outcomes related to information, media, and technology skills are included in the Turkish Language and Literature curriculum. From the findings obtained, it was determined that 21 objectives related to information, media and technology skills are largely in the Mathematics curriculum and the least number of outcomes was found in the Turkish Language and Literature curriculum. Another finding obtained from the content analysis is that there were no outcomes related to problem-solving skills in all three curricula. In addition, it was concluded that the outcomes related to security and digital content production in the curricula were quite inadequate quantitatively. It was determined that the most common outcomes in the curricula were related to communication and collaboration skills.

4. Discussion and Conclusions

In the study in which 12th-grade students' level of competence in information, media, and technology skills was investigated, it was revealed that students perceived themselves to be moderately competent. The findings support the results of Hazar's [37] study. The study revealed that students perceived their proficiency levels to be relatively low in programming skills in particular. Barut et al. [38] also reached similar results in their study. Programming, which involves the execution of algorithms to create digital works such as music, images, and websites, enables the creation of platforms and content that allow individuals to be creative and communicate their ideas [39]. In this context, it is considered to be extremely significant that students' acquisition of programming skills is improved, and programming education is included in curricula [38]. Mahmud and Wong [40] pointed out that programming is an important 21st-century skill that should be included in curricula and emphasized that programming skills are a necessity for students' future careers. Another result obtained from the study is that students consider themselves inadequate in problem-solving skills, which is one of the sub-dimensions of information, media, and technology skills. During face-to-face interviews with teachers, it was concluded that teachers' activities aimed at developing students' problem-solving skills in teaching activities were inadequate. The results reveal that the findings obtained from students and teachers support each other. It is recommended that teachers utilize digital tools and approaches to improve students' problem-solving skills in their teaching activities. Sarıkoz and Alpan [41] reached similar results in their study with teachers and students, concluding that the problem-solving abilities of teachers and students were at a low level. Wismath et al. [42], referring to problem-solving as a critical component of

21st-century education, emphasized that teaching problem-solving skills cannot be well achieved in a traditional lecture format classroom. In order for students to develop such skills, structured active learning environments are needed to facilitate the introduction, application, and deep understanding of problem-solving as a process [42]. In this context, programs suitable for developing students' problem-solving skills should be designed, and problem-solving outcomes should be included in these programs. Students considered their level of use of security skills, which are among the information, media, and technology skills, to be at a moderate level. Similar results were obtained in a study conducted to determine students' information security awareness levels [43]. In addition, in the study conducted by Hazar, it was determined that the students' use of security skills was at a moderate level. The findings reveal that students need training on the risks encountered in virtual environments and safe internet use. It is, therefore, necessary to include outcomes that will improve students' knowledge and skills about virtual threats and safe internet use in curricula.

The study also aimed to determine the level of students' use of multidimensional 21st-century skills. The results revealed that students' level of use of such skills was generally high. The study revealed that students perceived themselves to be most competent in career consciousness skills. The findings of previous studies in the literature conducted with high school students in recent years support the results obtained in this study. In their studies, Çelik [44] and Zeybek [45] revealed that high school students perceived their 21st-century skills proficiency to be above the average. Aktürk [46] stated that as the family income level increase, the extent to which students possessed 21st-century skills increase. Önür and Kozikoğlu [47] found that students who have technological tools such as computers, smartphones, and tablets perceive their 21st-century learning skills to be at a higher level compared to students who do not. In order for students to acquire 21st-century skills, equal opportunities should be provided in education, and the learning environments of students with low socio-economic status should be supported.

The results obtained regarding the activities carried out by the teachers to develop students' problem-solving skills are not satisfactory. While some of the teachers who expressed their opinions in the research utilized digital tools in their lessons, it was determined that some of them taught using traditional methods, and a rote understanding was dominant. This creates an obstacle, particularly in the development of students' higher-order thinking skills, such as problem-solving. It is extremely important for teachers to design learning and teaching environments suitable for developing students' information, media, and technology skills, and it is considered a necessity for teachers to graduate with these competencies, particularly during the teacher education process. In this context, it is recommended that teacher training programs should be specifically designed to include information, media, and technology skills. The Ministry of National Education of the northern part of Cyprus should support teachers with in-service training on the creation of learning-teaching environments that will provide students with 21st-century skills such as problem-solving and programming instead of traditional classroom environments.

When the 12th grade Turkish Language and Literature, English, and Mathematics curricula were examined in terms of outcomes covered related to information, media, and technology skills, it was revealed that mathematics was the curriculum with the highest number of outcomes. The program with the least number of outcomes related to information, media, and technology skills was the Turkish Language and Literature curriculum. When the objectives aimed at developing students' problem-solving, security, and digital content production skills were examined, it was determined that the objectives were quantitatively insufficient in all three curricula. Similar results were found in studies examining the inclusion of 21st-century skills in curricula. For example, studies have revealed that curricula do not cover all 21st-century skills [18,48,49]. In order for students to acquire 21st-century skills, curricula should be designed to cover all of these skills. It is seen as a necessity for learners to possess 21st-century skills, and that the curricula implemented in schools should be designed according to the needs of both society and

students and cover the information, media, and technology skills needed in information societies. Considering the results obtained from the research, it is necessary for the Ministry of National Education of the northern part of Cyprus to support teachers and school administrators with seminars and workshops focused on designing 21st-century learning and teaching environments and planning activities to provide these skills to students. Similarly, the Curriculum Development Unit of the Ministry of National Education of the northern part of Cyprus should initiate curriculum development studies in accordance with P21 standards, which will provide students with the skills needed in the 21st century while the current programs being implemented should also be evaluated and reorganized. The literature review did not reveal any studies aimed at determining the level of 21st-century skills usage by students studying in Northern Cyprus. In particular, it is important to determine the extent to which curricula cover 21st-century skills, which is a necessity for the education system in the northern part of Cyprus. In this context, it is suggested that researchers should examine the curricula implemented at different levels and disciplines to determine the extent to which the curricula cover 21st-century skills. Redesigning the curricula to reflect 21st-century skills is a significant development in terms of providing the manpower needed in the northern part of Cyprus.

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