# ADAPTATION INTO TURKISH OF THE COMPUTATIONAL THINKING TEST FOR PRIMARY SCHOOL STUDENTS

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## Abstract

*Computational thinking is recognized as a vital skill related to problem-solving in technological and non-technological fields. The existence of different sub-domains related to this skill has been pointed out. Therefore, there is a need for tools that measure these different sub-domains. Because of its structure that includes different skills, computational thinking has a structure different from that of the tools used to measure academic skills. Moreover, no special programming knowledge is required for tools that measure this ability. In order to measure this skill in younger age groups, it is possible to apply the measurement tool without adult support. At this point, it is aimed to reveal the computational thinking skills of Turkish children by adapting a test developed for the 7-9 age groups into Turkish. For this purpose, an adaptation research study was performed for TechCheck-2 developed by Relkin et al. (2020). In the study, a total of 372 primary school students studying in Ankara were contacted. Item and test analyses were performed on the data obtained as a result of the application of the test. The distinctiveness and difficulty values of the items making up the test and Kuder Richardson-20 scores were calculated. At the end of the analyses, it was seen that the test could be used as a valid and reliable measurement tool for Turkish children.*
**Keywords**: *computational thinking, item analysis, test adaptation, primary school student*

## Introduction

Humankind is in a massive technological transformation. During this transformation, people who are integrated with the industry 4.0 revolution will have to produce solutions to new events and problems that they have never encountered before, and to continue their existence by thinking in new contexts and systems. While some jobs will be disappeared from the face of the earth, futurists emphasize the importance of individuals making decisions that determine their career goals and future decisions and developing themselves in line with these decisions. In this respect, today's educational institutions should adopt a proactive approach, educate individuals in accordance with their future vision, and equip them with the necessary skills. Computational thinking (CT) can be considered one of these skills (Denning, 2009) because as the importance of problem-solving skills such as abstraction, decomposition, algorithmic design, generalization, and evaluation increases, the interest in developing CT thinking in schools has started to increase (Voogt et al., 2015). This interest stems from the need to learn digital languages, which are necessary to be successful in the digital world, to learn coding as a way of solving problems and CT as a working paradigm (García-Peñalvo & Mendes, 2018). This emerging need indicated that CT thinking skills should be gained from an early age.

According to Wing (2008), CT skill is an approach that incorporates computational fundamental concepts for solving problems, designing systems, and understanding human behaviour. This approach is a set of ideas that allow individuals to understand the world around them (Brennan & Resnick, 2012; Chalmers, 2018). Denning and Tedre (2019) considered some mental practices necessary in order to put these ideas into practice. The International Association for Technology in Education (ISTE, 2011) states that CT is a problem-solving process in which formulations are made using computers and other tools, emphasizing that it is a combination of organizing and analysing data that puts data in a logical order and automating solutions through algorithmic thinking. D'Alba and Huett (2017) have stated that in order to understand CT, it is necessary to distinguish between what computers can do better than humans and what humans can do better than computers, and that problems can be solved only by designing efficient systems in this way. Shute et al. (2017) examined the models in the CT-related literature and defined CT as the conceptual basis needed to solve problems effectively and efficiently (e.g., with or without computer aid with algorithms) including solutions that can be used in different contexts. Berland and Lee (2011) have considered CT within five categories (conditional logic, algorithm building, debugging, simulation, and distributed computing) and two stages (local logic and global logic). In the literature, it is seen that algorithmic thinking, debugging, and parsing dimensions are frequently mentioned (Tosik Gün & Güyer, 2019; Üzümcü & Bay, 2018). Grover (2021) has stated that CT is an important tool for participation in the 21st century career opportunities and cultural context in both academic and non-academic settings. Therefore, maximizing students' CT skills is important for their future. That is why qualified measurement tools are needed to determine how successful children are in CT activities. Many researchers have stated in their studies that there are deficiencies in measuring CT skills with assessment-evaluation tools suitable for age group and education level, and that the number of valid and reliable measurement tools for CT is low (Tosik Gün & Güyer, 2019). Top and Arabacıoğlu (2021), in their research in which they analysed studies on CT, determined that Likert-type scales were mostly used to measure this skill in research. Assessments based on the person's own evaluations may be insufficient to measure CT skill. In addition, tools measuring skills in different categories related to CT have not yet become widespread enough (Eguchi & Urive, 2009). Research on CT in Turkey have focused mostly on secondary school (Çetin et al., 2020; Güler & Dinci, 2019; İbili & Günbatar, 2020; Paf, 2019), high school (Bulut & Yılmaz, 2021; İbili et al., 2020), and university students (Akgün, 2020; Yel, 2021). Studies focusing on CT skills in younger age groups are relatively rare. This situation can be explained by the lack of valid and reliable measurement tools developed on this subject. Therefore, the development of tools that measure CT skills or the adaptation of tools with international applications to Turkish will support the research in this field. For this reason, in the present research, it is aimed to reveal the CT skills of Turkish children by adapting the CT test (Relkin et al., 2020) developed for the 7-9 age groups into Turkish.

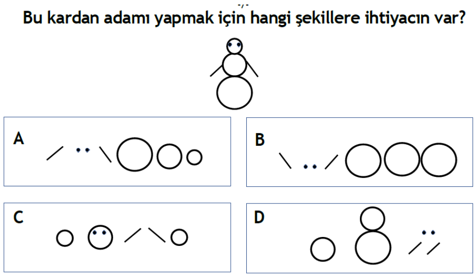
### *Computational Thinking Test for Primary School Students*

Relkin et al. (2020) have developed tests for different age groups entitled "TechCheck". According to this,

- TechCheck-K is best for children 5-6 years old (kindergarten)
- TechCheck-1 is best for children 6-7 years old (first grade)
- TechCheck-2 is best for children 7-9 years old (second grade)

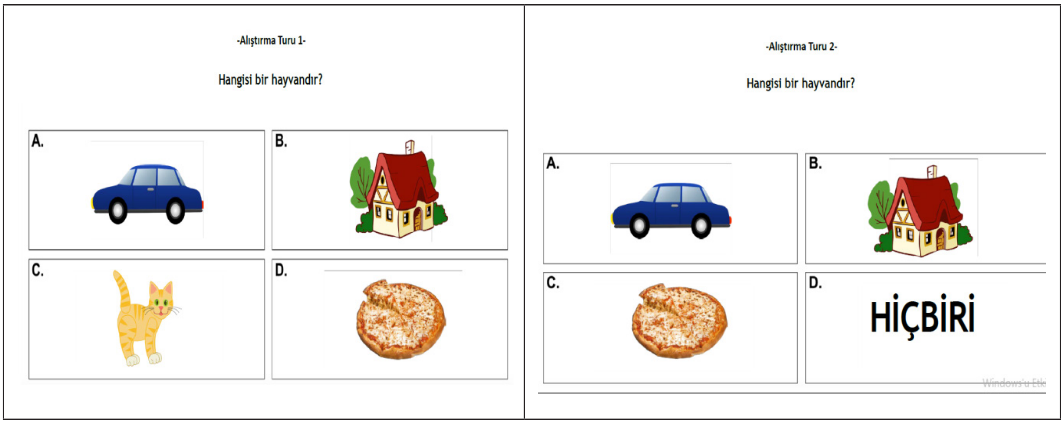
In the present research, an adaptation study on the TechCheck-2 version of the TechCheck test was carried out. For TechCheck-2, students can read and answer questions on their own without the help of an adult (teacher or parent). The test includes questions in four areas covering CT skills. This includes algorithmic thinking (missing symbol series, shortest path puzzles, sequencing challenge), modular structure (object decomposition), control structures (obstacle mazes), representation (symbol shape puzzles), software/hardware (identifying technological concepts), and debugging. There are different types of questions in the fields of symmetry problem-solving. The questions in the test are based on important ideas for CT expressed by Bers (2017). The connection between the question contents and the important ideas is presented in Table 1.

**Table 1**
*CT Test Domains*

<table>
<tr><th>Domain</th><th>Task Type</th><th>Sample</th></tr>
<tr><td>Algorithmic Thinking</td><td>missing symbol series, shortest path puzzles, sequencing challenge</td><td>
</td></tr>
<tr><td>Modular Structure</td><td>object decomposition</td><td>
</td></tr>
<tr><td>Control Structures</td><td>obstacle mazes</td><td>
</td></tr>
</table>

The test can be applied face-to-face or with the help of online platforms (e.g., Qualtrics, Ispring, pear deck). In the face-to-face application, an average of 12 minutes is sufficient. The questions in TechCheck-2 are similar to those in TechCheck-1, but the level of difficulty varies. There are 17 questions in total in the test, but the first two questions are not included in the scoring (Figure 1). The first two questions at the beginning of the test are included as practice round questions. The questions in the test are scored as 1-0 and the total score is calculated. There are four options in the multiple-choice test. The items created for the test were analysed and evaluated separately, depending on both the item response theory and the classical item theory. The Cronbach's alpha value calculated for the original test is .68 (Relkin et al., 2020).

**Figure 1**
*Practice Round Questions*




*Research Purpose*

The aim of the present research was to adapt the TechCheck-2 version of the "TechCheck" test developed by Relkin et al. (2020) into Turkish. Within the scope of CT skills, a test adaptation was carried out at the preschool level, which was previously under the umbrella of basic education (Ülker Hançer et al., 2021). However, no measurement tool developed in Turkish at the primary school level was encountered. In today's computer-based society, it is necessary for children to be computer literate as users or creators of digital technology (Bers & Sullivan, 2019). Therefore, the use of a tool with validity and reliability in revealing these skill areas of Turkish children will be beneficial for researchers, teachers, and program development research.

## Research Methodology

The TechCheck-2 test developed by Relkin et al. (2020) was adapted into Turkish. In this context, the survey model was used. In the survey model, attempts are made to describe an existing situation (Çepni, 2010), but the causality is not explained (Büyüköztürk et al., 2012). In the present study, researchers tried to reveal an existing situation through a sample taken from the population.

*Group*

The participants in the study were 2nd- and 3rd-year students studying in Ankara in the 2021-2022 academic year. Relkin et al. (2020) mentioned that the age range in which the TechCheck-2 test can be applied is 7-9. Therefore, for the Turkish adaptation, the study was carried out with primary school students in the same age group. A convenience sampling technique was used to collect the data. The convenience sampling technique is a method that accelerates the research because it allows the researcher to act according to the situation that is close and easy to access (Etikan et al., 2016). In this context, a total of 372 students ($n_{female}$ = 193, $n_{male}$ = 179) were contacted. While 157 of the students were studying in the 2nd grade, 215 of them were in the 3rd grade ($M_{age}$ = 7.9, $SD$ = 0.718).

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### *Instruments and Procedures*

In this adaptation research, the data were collected with the help of a questionnaire developed by the researchers. In the first part of the relevant questionnaire, the gender, age, and class information of the students were included. The second part of the questionnaire contained the articles of TechCheck-2 translated into Turkish. The final configuration of the questionnaire was delivered to primary school 2nd- and 3rd-grade students through classroom teachers after necessary permissions were obtained. The questionnaire was sent to the students online and the facilities of the schools they studied at were used to fill out the questionnaire.

### *Ethical Permissions*

Within the scope of the research, permission to use the TechCheck-2 test was first requested from the responsible author. The corresponding author asked the purpose of the test, the age group to which it would be applied, and the method to be followed in the analysis of the data and gave permission to use TechCheck-2 for the adaptation research in line with the purpose of this research. In this context, the scoring method of the test, the points to be considered in the application in face-to-face and online environments, the items that make up the test, and the answer key were sent to the researchers via e-mail. After obtaining the adaptation permissions, the form regarding the ethics committee permission, dated 2021 and decision number 573, obtained from the Social and Human Sciences Scientific Research Ethics Committee of Necmettin Erbakan University, was applied to the students who voluntarily agreed to participate in the research.

### *Test Adaptation Process*

After obtaining permission to use the relevant test, the test was first translated into Turkish by the researchers. The translation was sent to three experts along with the original. Two of the experts have very good English language skills and they are faculty members with doctorate degrees. One of the experts is an associate professor who has academic publications on CT skills. The experts compared the translated test with the original version and gave their opinions. For this, they contributed to the adaptation process by filling in the "appropriate, not appropriate, and justification" sections on the form sent to them. The test items translated into Turkish were not retranslated. Visuals are more important than expressions in test items, and expressions for primary school children should be quite clear and unambiguous. Therefore, it was sent to the Turkish teacher, who is doing a doctorate, to check the expressions translated into Turkish in terms of grammar and meaning. After obtaining confirmation about the appropriateness of the expressions in terms of Turkish, the test was administered to two primary school students who were not included in the sample. The aim was to check whether the test items were understood. With the feedback from the students, the test was finalized, and the application form was prepared.

### *Data Analysis*

The CT test is coded as 1-0. Therefore, the item difficulty values (pjx) and item discrimination values (rjx) were calculated for this test. Pjx is a measure of the extent to which the item is answered correctly, and as the obtained value approaches, the item becomes more difficult, and as it approaches 1, the item becomes easier (Tekin, 1991). Rjx, on the other hand, is a measure of how well the items distinguish between those who know and those who do not know about the measured feature. Accordingly, rjx takes a value between -1 and +1 (Turgut, 1992). In the literature (Tekin, 1991; Turgut, 1992), some cut-off points have been reported for pjx and rjx (Table 2). Accordingly, items with a value of .40 and above in terms of discrimination are considered very good, while items with a value of .19 and below are considered very weak. In terms of difficulty, items with a value of .61 and above were reported as easy, and items with a value of .39 and below were reported as difficult. Kuder Richardson-20 and 21 (KR-20/KR-21) coefficients are also used in tests coded as 1-0. These coefficients are used to determine the reliability of the test (Baykul, 2000). The fact that the value obtained in this method is close to 1 indicates that the reliability of the test is also high. A test analysis was conducted in terms of these values suggested in the literature. The data collected from the students were converted into .txt format and analysed with the item analysis program Test Analysis Program (TAP.exe).

**Table 2**
*Evaluation Chart for pjx, rjx, and KR-20*

| | | |
|---|---|---|
| rjx | .40≤ rjx | Very good |
| | .30 ≤ rjx≤ .39 | Quite good |
| | .20 ≤ rjx≤ .29 | Edited and developed |
| | .19 ≥ rjx | Very weak item should be excluded from testing |
| *p*jx | .61 ≤ pjx | Easy |
| | .60 ≤ pjx ≤ .40 | Medium |
| | .39 ≥ pjx | Difficult |
| KR-20 | .00 ≤ KR-20 < .40 | Unreliable |
| | .40 ≤ KR-20 < .60 | Low test scores |
| | .60 ≤ KR-20 < .90 | Quite reliable |
| | .90 ≤ KR-20 < 1.00 | Highly reliable |

## Research Results

The results obtained as a result of the item analysis are presented (Table 3). Accordingly, the minimum score taken from the adapted test is 1 and the maximum score is 15. The mean score of the test is 1 and the skewness and kurtosis values show that the data have a normal distribution (Hair et al., 1998). The score of the discrimination levels of the items in the test shows that the items in the test have a very good item structure (rjx = .458). In addition, it was observed that the items forming the test were at medium difficulty level (*p*jx = .674) and the test was quite reliable (KR-20 = .722). In this context, split-half reliability (.613) and Spearman–Brown coefficients (.760) were found to have very good values. The minimum score obtained by the students (*n* = 127) who responded to the test and were in the upper 27% for the test was 12, and the maximum score obtained by the students in the lower 27% segment was 8. In this way, it is possible to conclude that the test has a valid and reliable structure.

**Table 3**
*Test Analysis Results*

| Examinee Results | | Item Results | |
|---|---|---|---|
| Number of Examinees | 372 | *p*jx | .674 |
| Total Possible Score | 15 | rjx | .458 |
| Min Score | 1 | KR-20 | .722 |
| Max Score | 15 | KR-21 | .671 |
| Median Score | 10 | High Group Min Score (*n* = 127) | 12 |
| Mean Score | 10 | Low Group Max Score (*n* = 106) | 8 |
| *SD* | 2.970 | Split-Half Reliability | .613 |
| Skewness | -.356 | Spearman-Brown Coefficient | .760 |
| Kurtosis | -.299 | | |

The response status of each item forming the test by the students in the lower and upper groups, and the item difficulty and item discrimination scores were discussed (Table 4). Accordingly, it is seen that the items forming the test were answered proportionally by the upper and lower groups, and there was no problematic item. However, it is seen that question number 1 in the test is a very easy item (pjx = .90) and can be edited and improved (rjx = .22).

**Table 4**
*Item Analysis Results*

| Item | Number Correct | pjx | rjx | Correct in High Group (f / %) | Correct in Low Group (f / %) |
|---|---|---|---|---|---|
| Item 1 | 335 | .90 | .22 | 124 (.98) | 80 (.75) |
| Item 2 | 299 | .80 | .39 | 122 (.96) | 61 (.58) |
| Item 3 | 265 | .71 | .55 | 122 (.96) | 43 (.41) |
| Item 4 | 334 | .90 | .31 | 126 (.99) | 72 (.68) |
| Item 5 | 158 | .42 | .57 | 93 (.73) | 17 (.16) |
| Item 6 | 198 | .53 | .61 | 109 (.86) | 26 (.25) |
| Item 7 | 310 | .83 | .38 | 124 (.98) | 63 (.59) |
| Item 8 | 314 | .84 | .35 | 123 (.97) | 66 (.62) |
| Item 9 | 282 | .76 | .44 | 121 (.95) | 54 (.51) |
| Item 10 | 239 | .64 | .41 | 105 (.83) | 44 (.42) |
| Item 11 | 295 | .79 | .36 | 122 (.96) | 64 (.60) |
| Item 12 | 183 | .49 | .64 | 108 (.85) | 22 (.21) |
| Item 13 | 191 | .51 | .54 | 100 (.79) | 26 (.25) |
| Item 14 | 193 | .52 | .65 | 104 (.82) | 18 (.17) |
| Item 15 | 164 | .44 | .43 | 85 (.67) | 25 (.24) |

Finally, attempts were made to determine the effectiveness of the distracters of the items in the test (Table 5). Accordingly, the total answers given to each question, the answers given by the participants in the lower group, and the answers given by those in the upper group, and the difference between them are shown. When the questions in the test are considered one by one, it is seen that there is no more powerful distracter that can replace the answer key in the analysis made with the TAP.exe program. However, in some questions, it is seen that some options are marked by very few students. For example, 3 chose option A in the 1st question, 9 chose option B in the 3rd question, and 3 chose option C in the 7th question. This shows that these options are not very good distracters. However, this situation did not pose a problem in terms of the answers given by the students in the lower and upper groups to the questions. Considering the response rates given by those in the lower and upper groups to the questions in the test, it is seen that the correct answer option is marked more by those in the upper group. This shows that the questions in the test are appropriate in terms of discrimination.

**Table 5**
*Options Analysis*

| Item | Group | Option 1 (A) (rjx) | Option 2 (B) (rjx) | Option 3 (C) (rjx) | Option 4 (D) (rjx) |
|---|---|---|---|---|---|
| 1 | Total | 3 (.008) | 22 (.059) | 12 (.032) | 335* (.901) |
| | High | 1 (.008) | 2 (.016) | 0 (.000) | 124 (.976) |
| | Low | 2 (.019) | 13 (.123) | 11 (.104) | 80 (.755) |
| | Difference | -1 (-.011) | -11 (-.104) | -11 (-.104) | 44 (.222) |
| 2 | Total | 51 (.137) | 13 (.035) | 299*(.804) | 9 (.024) |
| | High | 2 (.016) | 1 (.008) | 122 (.961) | 2 (.016) |
| | Low | 27 (.255) | 12 (.113) | 61 (.575) | 6 (.057) |
| | Difference | -25(-.239) | 11(-.105) | 61 (.385) | -4(-.041) |
| 3 | Total | 22 (.059) | 9 (.024) | 76 (.204) | 265*(.712) |
| | High | 0 (.000) | 0 (.000) | 5 (.039) | 122 (.961) |
| | Low | 13 (.123) | 6 (.057) | 44 (.415) | 43 (.406) |
| | Difference | -13(-.123) | -6(-.057) | -39(-.376) | 79 (.555) |
| 4 | Total | 14 (.038) | 16 (.043) | 334*(.898) | 8 (.022) |
| | High | 0 (.000) | 1 (.008) | 126 (.992) | 0 (.000) |
| | Low | 14 (.132) | 13 (.123) | 72 (.679) | 7 (.066) |
| | Difference | -14(-.132) | -12(-.115) | -54 (.313) | 7(-.066) |
| 5 | Total | 158*(.425) | 51 (.137) | 77 (.207) | 86 (.231) |
| | High | 93 (.732) | 8 (.063) | 11 (.087) | 15 (.118) |
| | Low | 17 (.160) | 16 (.151) | 34 (.321) | 39 (.368) |
| | Difference | 76 (.572) | -8(-.088) | -23(-.234) | -24(-.250) |
| 6 | Total | 70 (.188) | 88 (.237) | 16 (.043) | 198*(.532) |
| | High | 3 (.024) | 15 (.118) | 0 (.000) | 109 (.858) |
| | Low | 33 (.311) | 37 (.349) | 10 (.094) | 26 (.245) |
| | Difference | -30(-.288) | -22(-.231) | -10(-.094) | 83 (.613) |
| 7 | Total | 310*(.833) | 6 (.016) | 3 (.008) | 53 (.142) |
| | High | 124 (.976) | 1 (.008) | 0 (.000) | 2 (.016) |
| | Low | 63 (.594) | 4 (.038) | 2 (.019) | 37 (.349) |
| | Difference | 61 (.382) | -3(-.030) | -2(-.019) | -35(-.333) |
| 8 | Total | 12 (.032) | 35 (.094) | 11 (.030) | 314*(.844) |
| | High | 1 (.008) | 1 (.008) | 2 (.016) | 123 (.969) |
| | Low | 7 (.066) | 29 (.274) | 4 (.038) | 66 (.623) |
| | Difference | -6(-.058) | -28(-.266) | -2(-.022) | 57 (.346) |
| 9 | Total | 38 (.102) | 282*(.758) | 18 (.048) | 34 (.091) |
| | High | 3 (.024) | 121 (.953) | 1 (.008) | 2 (.016) |
| | Low | 18 (.170) | 54 (.509) | 11 (.104) | 23 (.217) |
| | Difference | -15(-.146) | 67 (.443) | -10(-.096) | -21(-.201) |
| 10 | Total | 10 (.027) | 239*(.642) | 28 (.075) | 95 (.255) |
| | High | 0 (.000) | 105 (.827) | 1 (.008) | 21 (.165) |
| | Low | 6 (.057) | 44 (.415) | 19 (.179) | 37 (.349) |
| | Difference | -6(-.057) | 61 (.412) | -18(-.171) | -16(-.184) |
| 11 | Total | 295*(.793) | 29 (.078) | 26 (.070) | 22 (.059) |
| | High | 122 (.961) | 2 (.016) | 2 (.016) | 1 (.008) |
| | Low | 64 (.604) | 15 (.142) | 11 (.104) | 16 (.151) |
| | Difference | 58 (.357) | -13(-.126) | -9(-.088) | -15(-.143) |
| 12 | Total | 83 (.223) | 183*(.492) | 66 (.177) | 40 (.108) |
| | High | 6 (.047) | 108 (.850) | 9 (.071) | 4 (.031) |
| | Low | 35 (.330) | 22 (.208) | 25 (.236) | 24 (.226) |
| | Difference | -29(-.283) | 86 (.643) | -16(-.165) | -20(-.195) |
| 13 | Total | 56 (.151) | 66 (.177) | 191*(.513) | 59 (.159) |
| | High | 5 (.039) | 18 (.142) | 100 (.787) | 4 (.031) |
| | Low | 27 (.255) | 22 (.208) | 26 (.245) | 31 (.292) |
| | Difference | -22(-.215) | -4(-.066) | 74 (.542) | -27(-.261) |
| 14 | Total | 53 (.142) | 94 (.253) | 32 (.086) | 193*(.519) |
| | High | 8 (.063) | 14 (.110) | 1 (.008) | 104 (.819) |
| | Low | 29 (.274) | 41 (.387) | 18 (.170) | 18 (.170) |
| | Difference | -21(-.211) | -27(-.277) | -17(-.162) | 86 (.649) |
| 15 | Total | 15 (.040) | 164*(.441) | 23 (.062) | 170 (.457) |
| | High | 1 (.008) | 85 (.669) | 2 (.016) | 39 (.307) |
| | Low | 10 (.094) | 25 (.236) | 13 (.123) | 58 (.547) |
| | Difference | -9(-.086) | 60 (.433) | -11(-.107) | -19(-.240) |

**is keyed answer*

## Discussion

In the present research, TechCheck-2, a CT test developed by Relkin et al. (2020) for primary school students, was adapted. There are 15 questions in the test and these questions measure the dimensions of algorithmic thinking, modular structure, control structures, representation, software/hardware, and debugging associated with CT. As a result of the statistical analyses conducted, all items in the scale were suitable for inclusion in the Turkish version in accordance with the original scale. The high level of discrimination of the items in the test is an indication that they are successful in distinguishing students with high and low CT skills. In addition, the test contains items of medium difficulty that students of all ability levels can answer. An important condition for a test is that it is a valid and reliable scale in terms of its psychometric properties (Tekin, 1991). It has been determined that the test adapted within the scope of the present research is quite reliable; the KR-20 reliability coefficient was determined as .722. This coefficient is higher than the original scale's KR-20 value. This may be due to cultural conditions. An important issue for tests that measure ability is the comparison of the scores of the students in the lower 27% and upper 27% of the test. The reason for comparing the scores of the students in the 27% percentile is to increase the success differences in the normal distribution and provide sufficient examples for the analysis (Matlock-Hetzel, 1997). The comparison between the lower and upper groups for this test shows that it is reliable in terms of discrimination and that a sufficient sample is included for analysis. The strength of distracters is another important issue in multiple-choice test type scales (Tekin, 1991). In tests containing multiple-choice questions, students are required to choose between answer options, some of which may be partially correct. Partially true or false options are called “distracters” (Gierl et al., 2017) because they give partial information to students and distract the test solver because of the probability of being selected correctly (p.1084). In this test, which was adapted into Turkish, although some of the distracters did not work very well, they successfully distinguished the students who knew from those who did not.

## Conclusions and Implications

As a result, it is possible to conclude that TechCheck-2, which has been adapted into Turkish, is a very valid and reliable tool to objectively measure children's CT skills. Tang et al. (2020) stated that most of the measurement tools for CT include items on specific topics such as computer science or coding; therefore, there is a need for tools measuring this skill in general. The adapted TechCheck-2 can be used for general evaluation as it contains items independent of the subject area. Measuring CT skills with valid and reliable tools suitable for primary school students will enable the students to reveal their potential in this field, and it can also be used as a pre-test/post-test measurement tool in determining how effective the research and educational content for primary school students is. By determining which dimensions of students' skills are open to improvement within the scores to be obtained from this test, the relevant skill can be supported. It can also be useful for identifying students who need extra support and have special difficulties (Relkin et al., 2020). In addition, the relationships between students' literacy skills and CT skills can be revealed with this test. The present research was limited to the students who participated in the test application from the province of Ankara. In future, a wider sample can be included by collecting data from students from different provinces in Turkey. Thus, the CT development of Turkish students can be discussed by using it in both survey and experimental research.

## Ethical Approval

Ethical approval for the research written permission was also granted by the Ethics Committee of Necmettin Erbakan University (Decision No: 2021/573).

## Declaration of Interest

The authors declare no competing interest.

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