Validation of Pre-Adolescent Decision-Making Competence in Turkish students

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Abstract

The objective of this study was to adapt the Pre-Adolescent Decision-Making Competence Test to Turkish, which was originally developed in English by Weller, Levin, Rose and Bossard (2012) for assessing decision-making competence of children between the ages of 9 and 14. For this purpose; a) the test and instructions were translated into Turkish, b) the Turkish test was administered to a group of 398 students as a pilot, c) retest was administered to a group of 97 students, and finally, d) a group of 382 students was subject to a norm study. The Confirmatory Factor Analysis model created by the data of the pilot administration was well adapted, and one-factor model was verified for construct validity. As the construct of the test was altered, a Confirmatory Factor Analysis was performed on the data obtained from the norm study. A construct similar to that acquired from the data of the first test administration and the results obtained have even relatively better fit indices. Although the reliability values were less than what was expected, Cronbach's Alpha coefficient of internal consistency was similar to the results obtained from the original test.

Keywords: decision-making competence, preadolescence, test validation

1   Introduction

Decision-making can be defined as determining the goals to be achieved to meet a need, generating the possible choices, and selecting the most appropriate choice for the situation (Baron, 2008; Plous, 1993). The effectiveness of this process depends on the individuals' level of general decision-making skills. It is important to identify these skills, since they are related to risky behaviors. Students with low levels of decision-making skills show a higher tendency towards risky behaviors and make wrong decisions in significant situations affecting both their lives and the lives of others (Baron, 2008; Newell & Broder, 2008; Parker, Bruine de Bruin, Fischhoff & Weller, 2018; Toplak, Jain & Tannock, 2005). Parker and Fischoff (2005) found that adolescents with low level of decision-making skills show risky behaviors such as substance abuse and committing crimes at a higher level. Weller, Levin, Rose and Bossard (2012) reported that children at the

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age of 10 or 11 with higher decision-making levels show more positive behaviors (e.g., obtaining the highest grade on an exam) while those with lower decision-making levels show more negative behaviors (e.g., being called to the principal's office for making a mistake). Another study by Weller, Moholy, Bossard and Levin (2015) indicated that decision-making skills predict students' future behaviors.

No comprehensive tests exist to determine the levels of decision-making skills among school children in Turkey. This study aims to adapt the test of Preadolescent Decision-Making Competence (PA-DMC), developed by Weller et al. (2012), to Turkish and test the validity and reliability with a sample of primary and middle school students.

1.1   Decision-making competence

Decision-making competence is defined as a trait related to rational responses (based on a certain normative standard) to decision problems (Parker & Fischhoff, 2005). Basic decision-making skills are:

a) Belief assessment — judging the incidence occurrence possibility and the risks;

b) Value assessment — distinguishing the redundant information or situations or those that are not related to the decision problem;

c) Integration — integrating the beliefs and values while making a decision; and

d) Metacognition — having a metacognitive awareness of information regarding the decision (Bruine de Bruin, Parker & Fischhoff, 2007; Parker & Fischhoff, 2005).

The performance of these skills is evaluated based on two rationality criteria:

a) accuracy of the judgments or choices (e.g., making an optimal choice based on the decision rules among the alternatives that differ by many aspects);

b) consistency between judgments or choices (e.g., making consistent decisions in situations expressed in different contexts) (Parker & Fischhoff, 2005; Weller et al., 2012; 2015).

Some tests assess individuals' performance in different decision-making tasks to determine the level of each basic skill for them. For example, Parker and Fischhoff (2005) developed the Youth Decision-Making Competence (Y-DMC). This test includes seven tasks that represent the core decision making skills: Resistance to Framing, Recognizing Social Norms, Under/Overconfidence, Applying Decision Rules, Consistency in Risk Perception, Path Independence, and Resistance to Sunk Costs. The test was validated with 110 young people aged 18 and 19 and found to have a single-factor structure. However, the subscales had a poor correlation and the three subscales (Resistance to Framing, Consistency in Risk Perception, and Resistance to Sunk Costs) had a low internal consistency.

Bruine de Bruin et al. (2007) developed the Adult Decision-Making Competence (the A-DMC) by adapting the tasks in the Y-DMC for adults. New items were added to the test and the response modes of some subscales (Consistency in Risk Perception and Resistance to Sunk Costs) were changed from dichotomous choice to rating scale. These changes improved the test's psychometric features in that higher validity and reliability measurements were obtained compared to the youth version. While the single-factor model explains 30.1% of the variance, the two-factor model explained 46.2% of the variance. The two-factor model is defined as: Factor 1, Resistance to Framing, Under/Overconfidence, Applying Decision Rules, and Consistency in Risk Perception; and Factor 2, Recognizing Social Norms, Resistance to Sunk Costs, and Path Independence. However, the Path Independence subscale was then removed from the test since it had no relationship with other subscales and a low factor loading.

The revised A-DMC consists of six subscales and has been adapted to different cultures. For example, Bavolar (2013) tested the validity of the Slovak version of the test with a sample of 508 high school and university students. The results validated the Slovak A-DMC and showed that the psychometric characteristics (correlations between subscales, internal consistency values, and factor structure) was similar to those reported by Bruine de Bruin et al. (2007). Similarly, Liang and Zou (2018) validated the Chinese version of the test with 364 university students. The results showed that the reliability values of the Chinese A-DMC expressed by internal consistency were similar to those of the Slovak and English versions. However, the two-factor model

that explained 46.42% of the variance (Factor 1: Applying Decision Rules, Resistance to Framing, and Recognizing Social Norms; Factor 2: Under/Overconfidence, Consistency in Risk Perception, and Resistance to Sunk Costs) was found to be different from the factor structure of the Slovak and English A-DMC. Liang and Zou (2018) indicated that this difference may have been observed due to cultural differences and the two-factor model covered all the core skills regarding DMC.

In addition, Weller et al. (2012) developed the Preadolescent Decision-Making Competence Test (PA-DMC) to analyze the DMC of children. They ensured that the tasks in the test are comprehensible for children and related to subjects with which they are familiar (e.g., making a choice among the teaching methods). Two subscales in the Y-DMC and A-DMC, Path Independence and Recognizing Social Norms, were not included in this test. The researchers did not include the Path Independence since it had a low level of external validity, and the Recognizing Social Norms since the focus was on measures that were more closely related to classic judgment and decision-making (JDM) paradigms. In addition, they chose to leave Resistance to Sunk Costs out of the composite score since it was inversely associated with the other DMC indicators. The test included the following subscales: Resistance to Framing, Under/Overconfidence, Applying Decision Rules, and Consistency in Risk Perception. The explanations and psychometric characteristics regarding these subscales are presented in detail in the Measures section.

2 Method

2.1 Subjects

398 students participated in the pilot administration (202 females, 50,8% and 196 males 49.2%). The average age of the sample was 11.23 years (SD=1.346, range=6). Norm administration included 382 students (179 females, 46,9% and 203 males %53,1). The average age in the sample was 11.96 years (SD=1.389, range=9). Table 1 shows the frequency and percent for the demographic characteristics of subjects.

2.2 Measures

The PA-DMC was developed by Weller et al. (2012) to determine the decision-making competence of children aged 9 to 14 and included four subscales. The scores on each subscale were standardized to obtain a total decision-making competence score. The core decision-making subscales in the test are as follows:

TABLE 1: Demographic characteristics of the subjects for pilot and norm administration.

		Pilot		Norm	
		Freqency	Percent.	Frequency	Percent
Gender	Male	196	49.2	203	53.1
	Female	202	50.8	179	46.9
Age	9 or 10	127	31.9	64	16.8
	11	121	30.4	76	19.9
	12	69	17.3	103	27
	13	60	15.1	83	21.7
	14+	21	5.3	56	14.7
Grade	4	63	15.8	56	14.7
	5	87	21.9	53	13.9
	6	121	30.4	133	34.8
	7	64	16.1	67	17.5
	8	63	15.8	73	19.1
	Total	398	100	382	100

2.2.1 Resistance to framing

Kahneman and Tversky (1979) reported that the presentation of the decision-making problems (e.g., putting an emphasis on losses or gains in the choices) affects individuals' decision-making behaviors. The test included six problems: three risky choice framing and three attribute framing. The problems measured the proportion of answers to the decision-making scenarios with the same results, independent of the frames. In risky choice framing, individuals were asked to choose one of the choices framed in two different ways for a possible risky situation. For example, the possible results of a practice aiming at saving endangered animals were expressed in positive (saved animals) or negative (animals that cannot be saved) ways and individuals were asked to choose one of the expressions. In attribute framing, for example, individuals were asked to determine the effectiveness of a common cold treatment expressed as "treats 75% of the users" or "does not treat 25% of the users". Each participant answered one of the positive and negative framing scenarios in the first session, and the other in the second session (about a week or ten days later). The participants marked their choices on a 6-point scale (1="I would probably choose A" and 6="I would probably choose B"). The performance is measured by the absolute mean difference of the answers given to both versions of the same items. If this difference was zero, it means a complete resistance to the framing. The results are multiplied by −1 to indicate that high negative scores had a higher framing effect (Parker & Fischoff, 2005;

Weller et al., 2012).

2.2.2 Under/overconfidence

Overconfidence, a significant resource of cognitive errors (Kökdemir, 2003), was reported to cause wrong decisions and appeared particularly when making decisions about the subjects or situations that individuals do not fully know (Lichtenstein & Fischhoff, 1977). In this section, the participants were asked to answer 18 true-false items on general culture (e.g., "The first person to fly in space was from the United States") and their confidence about their answers on a scale ranging between 50% (I only guess) and 100% (I am absolutely sure). These items assessed the correctness level of their evaluation on their knowledge. The performance measurement was expressed by subtracting the absolute value of the difference between mean confidence and correct answer rate from 1 (1-|Mean Confidence−Correct Answer Rate|). Higher scores indicate higher performance (Parker & Fischoff, 2005; Weller et al., 2012).

2.2.3 Applying decision rules

During decision-making processes, where a selection is made between the alternatives based on various characteristics, the alternatives are rated based on certain criteria or goals and put in an order. Chankong and Haimes (1983) defined the set of rules which ensure that each alternative was rated considering the others as *decision rules*. In this section, individuals' skills of correctly applying certain decision rules were assessed through 6 items, which present various game consoles and their values (low to high) based on five core characteristics (ease of use, image quality, range and selection of games, and price) on a table. Individuals were asked to make a choice among the game consoles by applying certain decision rules (e.g., "Jackie only cares about how easy the video game system is to use," describing a single feature rule). The items differed by complexity. Each item had a single correct answer and the performance was assessed by adding up the correct answers (Parker & Fischoff, 2005; Weller et al., 2012).

2.2.4 Consistency in risk perception

This task measured how the individuals complied with the rules of probability. The participants were asked to mark their answers to 14 items regarding the possibility of experiencing an incident on a scale between 0% (impossible) and 100% (definitely). They evaluated seven incidents (e.g., "What is the probability that you will be injured during an activity/sporting event?") in terms of their possibility of occurring in a month in the first session and the possibility of it occurring during a month in two years in the second session (about a week or ten days later). The correct answer was considered to be no higher possibility of occurrence of

an incident in the following month than in the following two years. The sum of the correct answers yielded the performance measurement (Parker & Fischoff, 2005; Weller et al., 2012).

The reliability study of the original test was conducted with 108 students aged 10 and 11 living in Iowa, USA. The Cronbach's Alpha internal consistency coefficients were as follows for the subscales: Resistance to Framing (r=0.41), Under/Overconfidence (r=0.79), Applying Decision Rules (r=0.50), and Consistency in Risk Perception (r=0.53). The subscales showed significant positive relationships and the results were consistent with the measurements obtained on the other decision-making competence tests (e.g., A-DMC) (Weller et al., 2012). The construct validity of the original test was assessed through Confirmatory Factor Analysis (CFA). The analysis showed that the single-factor that consists of 4 subscales showed a high level of fit (χ^2(2)=0.04, p=0.91; CFI=1.00, RMSEA=0.00, SRMR=0.003, BIC=629.42 (Weller et al., 2012).

2.3 Procedure

The following steps were followed during the adaptation of the PA-DMC to Turkish.

a. Preparing the measurement tool and instructions in Turkish.

　i. Obtaining the experts' opinions.

　ii. Conducting a pilot study with 24 students and revising the measurement tool.

b. Conducting a pilot administration of the PA-DMC with a group of 398 people (Study 1).

c. Conducting a test-retest of the PA-DMC with a group of 97 people.

d. Conducting a norm administration of the PA-DMC with a group of 382 people (Study 2).

The adaptation process is explained in detail as follows:

2.3.1 Translation and the pilot study

First, the authors translated the test into Turkish and indicated the Turkish equivalents of some concepts based on the literature. In Turkey, the Ministry of National Education's permission should be obtained before collecting data in schools. During this process, authorities analyzed the test in detail and stated that the researchers cannot use two items in the Consistency in Risk Perception, and the questions should be changed. In this regard, the Y-DMC and A-DMC tests were analyzed, and these two items were changed based on the opinions of the original developers of the test. For example, the item "What is the probability that you will hit or punch someone because of an argument at school during the next month?" was replaced with the item "Gelecek bir ay içerisinde herhangi bir dersin sınavından düşük not alma ihtimaliniz nedir? (What is your possibility of getting

a low grade on any exam within the next month?)" Similarly, the item "What is the probability that you will smoke a cigarette during the next month?" was replaced with the item "Gelecek bir ay içerisinde bir eşyanızı kaybetme ihtimaliniz nedir? (What is your possibility of losing a property within the following month?)". The authors also made recommendations regarding the final section (Under/Overconfidence) of the test which includes culture-specific items. For example, they recommended to adapt the item "The biggest city in Iowa is Des Moines" in the original test as "İç Anadolu Bölgesinin nüfus açısından en kalabalık ili Ankara'dır (The most crowded city in the Central Anatolia Region is Ankara)". The translations were combined, and the test was revised through consensus. Then, two linguists who are fluent in Turkish and English from Hacettepe University Language Teaching, Application and Research Center (TÖMER) comparatively analyzed the Turkish and the original versions of the test and made recommendations. The linguists' recommendations were combined, and the test was re-sent to them. This process was repeated until a consensus was achieved. Then, opinions of an assessment and evaluation expert were obtained regarding the structure of the items and test characteristics and the recommended revisions were made on the test.

A pilot study was carried out with 24 students in a primary and a middle school (6 students from the 4th, 5th, 6th and 7th grades) in Çankaya, Ankara, which indicated the students' comprehension of the items and the time it took to complete the test (45 minutes on average). In addition, opinions of two social studies teachers and one primary school teacher were obtained on the Under/Overconfidence section and the final section was finalized. Then, the entire test was analyzed by a Turkish linguist and revised based on the linguist's recommendations on readability/comprehensiveness.

2.4 Study 1: Pilot administration

The finalized test was used in a second pilot administration in three primary and five middle schools in different districts of Ankara, Turkey. The data collection process took 2.5 months. In this process, three sections of the test were administered first (Applying Decision Rules, Consistency in Risk Perception 1, Resistance to Framing 1, and Under/Overconfidence) and data were collected from 452 students. Ten days later, two sections of the test (Consistency in Risk Perception 2, and Resistance to Framing 2) were administered to the same students and data were collected from 439 students. The data of 13 students could not be obtained during the second administration.

2.4.1 The reliability of the test

The internal consistency coefficient and test-retest method were used to assess the reliability of the test. In the first

method, the Cronbach's Alpha internal consistency coefficient was calculated for each subscale based on the data collected during the norm administration. In the test-retest method, data were collected from 116 students from the classes included in the pilot administration in each school and in each grade. First, the data were matched for the same students during the test-retest. The students from whom data were collected during both processes (pilot administration and test-retest) were identified by comparing one or some of the data of student number, grade, and teacher's name and surname. The matching yielded the data of 97 students.

2.5   Study 2: Norm administration

The norm administration was also carried out in three primary and five middle schools in different districts of Ankara, Turkey. The data collection process took three months. The 6-point Likert structure in the Resistance to Framing section was turned into 4-point Likert structure based on the results on the pilot administration and the opinions of the developers of the original test as well as an assessment and evaluation expert. Three sections of the test were first administered (Applying Decision Rules, Consistency in Risk Perception 1, Resistance to Framing 1, and Under/Overconfidence) and data were collected from 442 students. Ten days later, two sections of the test (Consistency in Risk Perception 2, and Resistance to Framing 2) were administered to the same students and data were collected from 428 students. This indicates a data loss from 14 students.

The next section shows the results of the test's validity and reliability studies.

3   Results

3.1   Study 1: Pilot administration

This section indicates the CFA findings of the single-factor test that consisted of four subscales. First, the answers of the participants who did not answer each subscale were excluded (non-random lost data) (n=41), therefore the CFA model was obtained on the 37-item test with a sample size of 398.

Table 2 shows the factor loadings of each item on the relevant subscale and whether these items significantly predict the relevant subscale. Only the third item had a factor loading of −0.026 on the Applying Decision Rules subscale, which was statistically insignificant (p=.714, p>.05). The researchers discussed omitting this item from the test and decided to include it based on the recommendations of both the assessment and evaluation experts and the original developers of the test.

Table 3 shows the values for fit indices for the one-factor model. According to Table 3, factor structure was similar to hypothesized (χ^2/623 = 1.42). The goodness of fit index (GFI=0.89), the adjusted goodness-of-fit index

TABLE 2:   Standardized loadings for the one-factor CFA model of PA-DMC.

Items	Path Coefficients	s.e.	t	p
Applying Decision Rules (ADR)				
ADR1	0.157	0.073	2.149	.032
ADR2	0.228	0.073	3.130	.002
ADR3	−0.026	0.072	−0.366	.714
ADR4	0.553	0.081	6.815	.000
ADR5	0.209	0.070	2.967	.003
ADR6	0.382	0.071	5.387	.000
Consistency in Risk Perceptions (CRP)				
CRP1	0.303	0.066	4.597	.000
CRP2	0.348	0.065	5.314	.000
CRP3	0.182	0.068	2.695	.007
CRP4	0.368	0.067	5.455	.000
CRP5	0.297	0.067	4.458	.000
CRP6	0.472	0.064	7.320	.000
CRP7	0.399	0.065	6.108	.000
Resistance to Framing (RF)				
RF1	0.286	0.089	3.217	.001
RF2	0.191	0.081	2.352	.019
RF3	0.215	0.087	2.463	.014
RF4	0.263	0.089	2.951	.003
RF5	0.484	0.096	5.044	.000
RF6	0.282	0.083	3.380	.001
Under/Overconfidence (UOC)				
UOC1	0.208	0.062	3.337	.001
UOC2	0.315	0.061	5.156	.000
UOC3	0.206	0.063	3.280	.001
UOC4	0.293	0.061	4.817	.000
UOC5	0.259	0.062	4.202	.000
UOC6	0.196	0.063	3.103	.002
UOC7	0.247	0.062	3.982	.000
UOC8	0.201	0.063	3.177	.001
UOC9	0.363	0.060	6.009	.000
UOC10	0.312	0.061	5.099	.000
UOC11	0.256	0.062	4.140	.000
UOC12	0.316	0.061	5.141	.000
UOC13	0.409	0.058	7.051	.000
UOC14	0.315	0.063	5.008	.000
UOC15	0.330	0.062	5.315	.000
UOC16	0.238	0.063	3.784	.000
UOC17	0.376	0.060	6.317	.000
UOC18	0.212	0.064	3.317	.001

TABLE 3: Descriptive statistics for the pretest and posttest scores.

	N	Min	Max	Mean	S.D.	Skewness	Kurtosis
Applying Decision Rules Pre	96	1	6	3.690	1.070	−0.337	−0.052
Applying Decision Rules Post	96	0	6	3.730	1.425	−0.658	−0.106
Consistency in Risk Perception Pre	96	2	7	5.350	1.336	−0.693	−0.16
Consistency in Risk Perception Post	96	0	7	4.820	1.582	−0.602	0.263
Resistance to Framing Pre	96	−22	−3	−9.690	4.121	−0.681	0.234
Resistance to Framing Post	96	−30	−1	−8.390	4.445	−1.493	4.844
Under/Overconfidence Pre	96	0.52	0.99	0.821	0.096	−0.529	0.249
Under/Overconfidence Post	96	0.54	0.99	0.825	0.088	−0.696	1.144
Total Pre	96	−14	9	0.18	4.649	−0.387	0.124
Total Post	96	−23	11	0.98	5.154	−1.25	4.118

TABLE 4: Fit indices for the one-factor structure of PA-DMC.

χ^2	df	χ^2/sd	GFI	AGFI	SRMR	RMSEA
884.70	623	1.42	.89	.88	.054	.033

(AGFI=0.88), the standardized root mean square residual (SRMR=.054 ≤ .08) and the root mean square error of approximation (RMSEA=.033 ≤ .05) indicate a good fit of the model (Hu & Bentler, 1999; Kline, 2005). The results, therefore, support the validity of the 4-indicator model.

3.2 The reliability of the test

3.2.1 Internal consistency results

Data collected during the norm administration were used to calculate the internal consistency coefficient for each subscale. The subscale generally had low internal consistency coefficients (Applying Decision Rules, r=0.54; Resistance to Framing, r=0.39; Consistency in Risk Perception, r=0.42; Under/Overconfidence, r=0.52). The low number of items in the subscales may have reduced their reliability (Weller et al., 2012). Another reason for low reliability may be the high level of lost data, which may have occurred because the items and ratings were not appropriate for children. Therefore, the items in the Resistance to Framing were changed from a 6-point Likert type scale to a 4-point Likert type scale during the norm administration. Another possible determinant of low reliability is that the children could not comprehend the items or understand their task. The original test, however yielded similar Cronbach's Alpha internal consistency coefficients except for the last section (Applying Decision Rules, r=0.50; Resistance to Framing, r= 0.41; Consistency in Risk Perception, r=0.53; Under/Overconfidence, r= 0.79).

3.2.2 Test-retest results

Table 4 shows the descriptive statistics of the students' scores on the test and its subscales. The test was readministered to 96 students at a 2-week interval (pre- and post-test) after the pilot administration. The mean scores were higher on the post-administration than on the pre-administration. The posttest scores may have increased because the children became familiar with the test due to the longitudinal study. The skewness and kurtosis values provided information on the normal data distribution, and data were assumed to be normal since these values were between −2 and +2 (Field, 2009; George & Mallery, 2010). The relationships between the participants' scores on the test after the measurement were analyzed using Pearson correlations.

Table 5 shows the correlation between the pre- and post-tests. The correlation between the pre- and post-tests on the Applying Decision Rules subscale was moderate, as was that for the Under/Overconfidence subscale. For the Consistency in Risk Perception and Resistance to Framing subscales, the correlation was low.

4 Study 2: Norm administration

We noticed that the students had difficulty in answering the items in the Resistance to Framing subscale during the first administration. Therefore, the 6-point Likert type scale in this section was changed to a 4-point Likert type scale during the second administration and the CFA had to be performed again since the test's structure changed. During this process, the opinions of the original developers of the test were first obtained and it was understood that this change was suitable. Then, both the 6-point and the 4-point Likert type tests were given to four students from each grade and they were asked to answer the questions by thinking aloud. The students found the items with 4-point Likert type more comprehensible and preferred to answer them. The CFA was also performed for

TABLE 5: Intercorrelations between the PA-DMC pretest and posttest scores (N=96).

	Pearson r	p
Applying Decision Rules Pre Applying Decision Rules Post	.413	.000
Consistency in Risk Perceptions Pre Consistency in Risk Perceptions Post	.227	.031
Resistance to Framing Pre Resistance to Framing Post	.249	.014
Under/Overconfidence Pre Under/Overconfidence Post	.211	.039
Total Pre Total Post	.447	.000

TABLE 6: Standardized loadings for the one-factor CFA model of PA-DMC.

Items	Path Coefficient	s.e.	t	p
Applying Decision Rules (ADR)				
ADR1	0.450	0.060	7.457	.000
ADR2	0.460	0.059	7.761	.000
ADR3	0.167	0.064	2.629	.009
ADR4	0.529	0.056	9.387	.000
ADR5	0.448	0.059	7.628	.000
ADR6	0.404	0.061	6.667	.000
Consistency in Risk Perceptions (CRP)				
CRP1	0.361	0.071	5.073	.000
CRP2	0.335	0.070	4.807	.000
CRP3	0.194	0.072	2.714	.007
CRP4	0.338	0.073	4.628	.000
CRP5	0.199	0.072	2.766	.006
CRP6	0.299	0.074	4.012	.000
CRP7	0.414	0.070	5.892	.000
Resistance to Framing (RF)				
RF1	0.219	0.068	3.207	.001
RF2	0.242	0.069	3.533	.000
RF3	0.346	0.069	5.009	.000
RF4	0.295	0.068	4.323	.000
RF5	0.267	0.069	3.901	.000
RF6	0.474	0.067	7.027	.000
Under/Overconfidence (UOC)				
UOC1	0.368	0.056	6.583	.000
UOC2	0.397	0.055	7.203	.000
UOC3	0.250	0.059	4.217	.000
UOC4	0.271	0.059	4.593	.000
UOC5	0.353	0.057	6.235	.000
UOC6	0.364	0.056	6.448	.000
UOC7	0.277	0.058	4.737	.000
UOC8	0.289	0.058	4.973	.000
UOC9	0.302	0.058	5.204	.000
UOC10	0.300	0.058	5.163	.000
UOC11	0.429	0.054	7.886	.000
UOC12	0.349	0.057	6.154	.000
UOC13	0.397	0.055	7.214	.000
UOC14	0.274	0.059	4.687	.000
UOC15	0.149	0.061	2.431	.015
UOC16	0.319	0.057	5.572	.000
UOC17	0.392	0.055	7.097	.000
UOC18	0.287	0.059	4.899	.000

the second administration to analyze whether the test's construct validity was similar to the first administration. The data of the participants who did not answer any of the subscales were excluded (non-random lost data) (n=46), The CFA model was obtained on the 37-item test with a sample size of 382.

Table 6 shows the factor loadings of each item on the relevant subscale and whether these items significantly predict the relevant subscale. The factor loadings of all items on the relevant subscales were found to be statistically significant (p<.05). Item 3 needed to be omitted in the first administration; however, it was found to be statistically significant and the need for omitting it was eliminated when the test's structure was changed. Table 7 shows the fit indices for the model.

Table 7 displays the goodness of fit statistics for the one-factor model. According to Table 7, the factor structure was similar to hypothesized ($\chi^2/623 = 1.28$). The goodness of fit index (GFI=0.90), the adjusted goodness-of-fit index (AGFI=0.88), the standardized root mean square residual (SRMR=.051 $\leq$ .08) and the root mean square error of approximation (RMSEA=.027 $\leq$ .05) indicate a good fit of the model (Hu ve Bentler, 1999; Kline, 2005).

5 Conclusions and discussion

This study aimed to adapt the PA-DMC and test its validity and reliability on a sample of primary and middle school students. For this purpose: a) the test and its instructions were translated into Turkish, b) a pilot administration was performed on a group of 398 people, c) tests-retests were administered to a group of 97 people, and d) a norm administration was performed on a group of 382 people.

TABLE 7: Fit indices for the one-factor structure of PA-DMC.

χ^2	df	χ^2/sd	GFI	AGFI	SRMR	RMSEA
800.77	623	1.28	.90	.88	.051	.027

The results replicated the factor structure of the PA-DMC in a different culture. The CFA model based on the data of the pilot administration was found to show a good fit and the single-factor test was confirmed in terms of construct validity. We observed that students had difficulty answering the items in the Resistance to Framing subscale during the first administration. Therefore, the response modes regarding these items in this subscale were changed from a 6-point Likert type scale to 4-point Likert type scale upon obtaining the opinions of assessment and evaluation experts and the original developers of the test. Since the test's structure changed, the CFA was performed again, which yielded a structure similar to the one obtained in the first administration and better fit indices. In addition, omission of the third item in the Applying Decision Rules subscale became unnecessary and it was kept in the test upon being reviewed by the researchers and specialists. The reliability values were lower than the expected values due to the low number of items in the subscales, the inappropriate or incomprehensible items and ratings for children, and the fact that children could not understand what they should do. On the other hand, the Cronbach's Alpha internal coefficients of the original test were similar to those found in the present study except for the Under/Overconfidence subscale.

There were limitations of this study. Although Weller et al. (2012) developed a "child-friendly" version by adapting and shortening the items on the A-DMC for children, it takes 40 minutes to complete the test. It may even take up to 50 minutes for the 9–10-year age group. This resulted in the participants getting bored, tired and leaving some items unanswered, which may have affected their real performance. The students particularly had difficulty in understanding the items in the Resistance to Framing subscale, where they spent a long time. Changing the Likert scale of these items made them easier to answer. However, the presentation of the items in the Applying Decision Rules subscale was found incomprehensible by some students (particularly for younger age groups). The figures used to indicate the ratings (from lower to higher) for the items in this section caused confusion. Indication of the ratings with numbers rather than figures may be more comprehensible for students. Changing this subscale of the test may shorten the time spent by students completing the test. This may enable more common use of the test in different contexts.

Another limitation was the exclusion of the Resistance to Sunk Costs subscale, which was inversely associated with the other subscales in the original PA-DMC, from the test in this study. Some studies reported that this subscale did not have a structure consistent with the other subscales or had a low factor load (Bruine de Bruin et al., 2007; Parker & Fischhoff, 2005). Nevertheless, the features of this subscale could have been analyzed for this culture. Moreover, the addition of the Recognizing Social Norms, Path Independence, and Resistance to Sunk Costs subscales of the A-DMC and Y-DMC into the PA-DMC may provide a more comprehensive perspective on the DMC during the preadolescent period. However, it should be noted that the lengthened test may lead to problems with time.

Another possible limitation of the present study is that only the Turkish version of the test was administered to the target group while ensuring the linguistic equivalence. Only the Turkish comprehensibility of the test was analyzed. However, the understanding of the test's structure may change by culture. Therefore, invariance testing should be conducted to gain confidence that the constructs have the same meanings across languages. The data on the English and Turkish versions of the test can be analyzed and the data obtained from the two cultures can be compared (Hambleton, 2005).

Despite all the limitations, the Turkish PA-DMC was found to be a valid and reliable test that can be used to determine the systematic differences in children's decision-making competence. Since there are no comprehensive tests to assess children's decision-making competence, this test can be used by other researchers who aim to analyze the decision-making competence of students aged between 9 and 14 within different contexts. Studies have also shown that the DMC tests are related to real life behaviors (Bruine de Bruin et al., 2007; Parker et al., 2018; Parker & Fischhoff, 2005; Weller et al., 2012, Weller et al., 2015). Studies can be conducted on the relationship between PA-DMC and real life decisions; and new evidence can be found on its external validity.

The PA-DMC can also be used in studies that aim to develop decision-making competence. Keelin, Schoemaker and Spetzler (2009) indicated that identification of mistakes during decision making and the factors that cause these mistakes will provide concrete data on the kinds of information, skills and attitudes covered by educational programs regarding rational decision-making processes. In this regard, appropriate learning opportunities may be created for those who need support with these skills by assessing decision-making competence levels at early ages. Moreover, individuals at early ages might acquire the required information, skills and attitudes more easily. Similarly, children with low decision-making competence may be provided with the support they need particularly before they exhibit high-risk behaviors during adolescence.

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