Investigation of education value perception scale's psychometric properties according to CTT and IRT

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Abstract: The purpose of this study is to develop Education Value Perception Scale (EVPS) based on Bronfenbrenner's Ecological Theory and to investigate its psychometric properties according to Classical Test Theory (CTT) and Item Response Theory (IRT). The data were collected from 2872 secondary school students by stratified purposeful sampling method. Measurement invariance of EVPS was tested by multigroup confirmatory factor analysis based on gender, and scalar invariance was observed to have been provided. The estimations based on IRT were conducted based on Graded Response Model. While high positive correlations were found between the item discriminations estimated according to different test theories, high negative correlations were identified between item means. McDonald's Omega was calculated to be .79 according to CTT from reliability estimation methods, marginal reliability coefficient was determined to be .77 according to IRT. In the test-retest applications performed at 20-day intervals, the stability coefficient was found to be .81.

1. INTRODUCTION

There are many psychological factors affecting students learning, and these factors influence education and training process (Özbay, 2018). A student should be motivated in order to become successful during education and training process, yet this motivation is not sufficient alone. External factors such as teacher feedback and assignments in line with skill level should also be appropriate (Kelecioğlu, 1992). As it can be understood, there are external factors affecting academic success. Prior studies show that academic success is affected by family attitudes, circle of friends, teachers, school dynamics, social environment (Arıcı, 2007; Sarıer, 2016; Sezgin et al., 2016; Tuncer & Bahadır, 2017). Bronfenbrenner (1977) explains such factors affecting academic success and an individual's interaction with environment under Ecological Theory. People interact with the environment where they live during their lives actively and passively, and these environmental factors influence people's development process in active and passive manners. As a result of the interaction of an individual with his/her family, friends and social environment, changes occur in his/her perceptions. These environmental factors are discussed in the Ecological Theory developed by Bronfenbrenner (1977; 1979;

1986; 1994). The Ecological Theory argues that there are five systems (microsystem, mesosystem, exosystem, macrosystem and chronosystem) surrounding an individual from close to far (Bronfenbrenner, 1979). While chronosystem was not mentioned in the first period when the theory was coined, its importance was emphasized by Bronfenbrenner (1994) in the following periods (Shelton, 2019). Although it was developed in a relatively old period, the Ecological Theory still draws interest and continues to develop by current studies (Aliyev et al., 2021; Santrock, 2011; Shelton, 2019). The systems explained by the Ecological Theory are as follows:

Microsystem: As the first system of the Ecological Theory, the microsystem refers to anybody in the close circle of an individual and with whom s/he has direct contact. Family, friends, teachers can be given as examples of microsystem elements. As a result of the relationships an individual has with these people, his/her subjective perceptions develop, and these perceptions affect an individual's development (Bronfenbrenner, 1979; Shaffer, 2009).

Mesosystem: Mesosystem, which is made up of microsystems, focuses on the relationships among the elements in the microsystem. This refers to the effect of the interactional relationship of at least two elements in the microsystem on an individual's development (Bronfenbrenner, 1979). This system may be exemplified by the relationship between a family and teachers, the relationship between teachers themselves, the relationship of a family with an individual's friends.

Exosystem: The elements of this system, with whom an individual does not have active relationships, affect an individual and his/her immediate circle. The results of events in this system influence an individual's perceptions indirectly (Santrock, 2011). Working environment of parents and decisions taken by the school administration can be given as examples of this system.

Macrosystem: In this system, the effect of countries, societies, ideologies, belief systems on an individual's development is examined (Bronfenbrenner, 1979). This system covers important decision-makers about the lives of individuals such as those who manage a government or education policies, and the elements guiding large masses such as media organs. The decisions taken by the elements covered in this system result in what individuals will learn, what kind of a life they will live (Shaffer, 2009).

Chronosystem: Indicating the effect of time change on the development, the chronosystem argues that when the properties of an individual change over time, the environment she lives also changes (Bronfenbrenner, 1994). This change occurs in two ways: expected changes and unexpected changes (Bronfenbrenner, 1986). While the transition between levels in school life, entry to business life, marriage, retirement can be given as examples of expected changes, death of a relative, immigration, divorce, diseases can be presented as examples of unexpected changes.

There are environmental elements affecting a student's education in the aforementioned Ecological Theory. These elements cause a student to have a perception regarding his/her education. The perception of education value is the perception of an individual regarding the factors affecting his/her education and the relations between them (Aliyev et al., 2021). Investigating peer bullying, its effects, causes and consequences under the Ecological Theory, Doğan (2010) emphasized the necessity to develop programs that would raise awareness and prevent peer bullying across the country. Hong and Eamon (2012) examined the perceptions of students aged between 10-15 about their insecurity of schools according to the microsystem, mesosystem and exosystem level of the Ecological Theory. The study concluded that the perceptions about the insecurity of schools differed in terms of sociodemographic aspects.

Espelage (2014) discussed aggression, bullying and victimization of young people in accordance with microsystem and mesosystem. He stated the necessity to conduct informative

studies for students, school staff, teachers and adults, emphasized the importance of cooperation and studies should be carried out in other systems of the Ecological Theory. In their study, Özenç and Doğan (2014) developed "Functional Literacy Experience Scale" based upon Ecological Theory for 5th grade students with 3 factors and 32 items. Gençtanırım (2015) discussed the prevention of adolescent suicides in line with the Ecological Theory. He stated the necessity to carry out prevention studies covering each system of the Ecological Theory in order to prevent adolescent suicides. Aslantürk (2018) developed the "School Safety Scale" consisting of 61 items with 12 factors based on Ecological Theory. Zorbaz and Bilge (2019) indicated that the approaches based on the Ecological Theory could be effective on the psychosocial skills of delinquent children. Kopan (2019) argued that nutritional habits of 10th grade students are associated with all systems of the Ecological Theory, and Ecological Theory based studies would urge students to a healthier nutrition. Aliyev et al. (2021) urges that perception of education value is among the predictors of academic resilience.

As seen above, the Ecological Theory is used in many fields, especially in educational psychology. In addition, parents consider education of their children valuable before they start school and make plans for the future (Mapp, 2002). For this reason, it was considered important to measure how children perceive the value given to their education. The reason for developing the measurement instrument for secondary school level is the fact that the students at this stage are between 10-14 age range and are in a developmental threshold. Secondary school students in adolescence are in the period of cognitive and psychosocial development and change (Arı, 2008). Determination of education perceptions of children in this period is of importance for taking required measures and fulfilling responses.

Dated back to the 20th century, Classical Test Theory (CTT) has been used by many researchers and is still used in ability tests, cognitive tests, personality measurements, and psychological measurements. In CTT, allowing to achieve true score based on the observed score by focusing on the whole test, the less the amount of error in the measurement, the closer the true score is. True score is formulated as follows in CTT: $T = X + e$. In this formula, "T" refers to true score, "X" indicates observed score and "e" shows the amount of error in the measurement (Crocker & Algina, 2008). In CTT, individual, test and item parameters depend on the group (Hambleton & Jones, 1993), and this is a basic limitation of the theory (Fan, 1998). This limitation is overcome by estimations based on Item Response Theory (IRT) (Ostini & Nering, 2006).

In IRT, parameter estimations are carried out based on the responses given to each item instead of whole test (Baker, 2001). In IRT, there are dichotomous and polytomous models according to the way the items are answered. Likert-type scales are classified under polytomous models. In this study, the Graded Response Model (GRM), which is a polytomous IRT model based on the 2-parameter logistic model, in which the responses are categorical and ordered, and the probability of responding to the categories above the category to which the individual reacts is estimated, was used (Embretson & Reise, 2000). The parameters estimated based on different theories were compared.

There are studies conducted based on different theories. Sarı and Karaman (2018) has examined the General Mattering Scale in terms of both CTT and IRT. Yaşar and Aybek (2019) have developed a Resilience Scale according to IRT. Arıcak et al. (2020) have attempted to validate the Cyberbullying Sensibility Scale, which has been developed for high school students, for university students based on IRT. In recent years, it is seen that IRT-based scale studies have been carried out.

2. METHOD

2.1. Study Group

When determining the participant number, it was considered that at least 200 participants should

be included in CTT based studies (Comrey & Lee, 1992), and at least 600 participants should be involved in IRT based studies (De Ayala, 2009). Though the study was planned on two applications, after the first application, schools were closed in Turkey as a result of the global COVID-19 pandemic. Therefore, the planned second application could not be actualized. However, since the data was collected from a large student group with the first application, the group was divided into two as it is accepted in the literature and the study is completed even though the study was initially planned on two groups. In this study, more than 300 students from each grade level were included. 2872 students were reached by the stratified purposeful sampling method, which aims to reveal the characteristics of a group and describe a group (Büyüköztürk et al., 2018). Next, the data set was divided into two groups randomly. While the first group (sample 1) was utilized for the development of Education Value Perception Scale (EVPS), the second group (sample 2) was used for the investigation of the psychometric properties of EVPS. The distribution of the data used by grades and genders is provided in Table 1.

Table 1. *Distribution of students in the study group by grade and gender.*

	Sample 1				Sample 2		
Grade	Male	Female	Total	Grade	Male	Female	Total
5th grade	160	185	345	5th grade	170	171	341
6th grade	202	169	371	6th grade	191	198	389
7th grade	161	154	315	7th grade	156	158	314
8th grade	186	210	396	8th grade	194	207	401
Total	709	718	1427	Total	711	734	1445

2.2. Data Collection Instruments

EVPS was developed under this study (see Appendix). The literature was reviewed before preparing items form (Aliyev et al., 2021; Bronfenbrenner, 1986; Bronfenbrenner & Ceci, 1994; Darling, 2007; Leonard, 2011; Tudge et al., 2009; Onwuegbuzie et al., 2013). Later on, a total of 24 secondary school students, studying in different grades, were asked to answer an open-ended question to measure the extent that their surrounding attaches importance to their own education. The answers of these students were examined, and it was seen that their answers progressed towards the macrosystem, while no expression was determined in the chronosystem stage. For example, one of the students expressed as follows: "Textbooks are given, there are smart boards in the classroom, the Ministry of National Education publishes sample questions and I examine these questions. All these are done so that I can get a good education". As a result of these studies, an item pool of 29 items was achieved. Receiving a high score from the scale indicates that the perception of education value is high. There is no reversed item in the scale.

Next, in order to receive expert opinion, these items were sent to a total of nine experts (7 PhD's and 2 PhD candidates), three of which were expert in assessment and evaluation in education, two of them in educational psychology, four of them in psychological counseling and guidance, all of them had studies on education value, scale development, developmental psychology. The expert opinions were analyzed by the Lawshe technique that is a method used to identify content validity of the items in items form (Yurdugül, 2005). As a result of the analysis, one item was removed by considering the criteria suggested by Ayre and Scally (2014), and the content validity index for 28 items was calculated as .93. Four items recommended by experts were added to the scale, and the items form of 32 items was provided. Before conducting a pilot study with this items form, a pre-pilot study was administered with 17 secondary school students studying at different grade levels in order to determine the clearness of the items at the student level. In this study, students were requested to explain why they marked the category, they

chose, in each item. These explanations were examined, and 13 items, perceived and interpreted differently by students, were decided to be removed. A pilot study was carried out with the remaining 19 items, which had four response categories as follows: "Not Proper For Me", "A Little Proper For Me", "Significantly Proper For Me", "Completely Proper For Me".

In order to specify criterion-related validation of the developed measurement instrument, the "family support sub-scale" of the Social Relationship Factors Scale developed by Turner et al. (1983) and adapted into Turkish by Duyan et al. (2013) was used. The answers that may be provided for items consisted of five categories ranging between "Never Applicable for Me" and "Completely Applicable for Me". A high score from the scale indicates high family support. The reason for using the family support sub-scale of this scale as a criterion is that the family has an important place at the microsystem level of the Ecological Theory.

In addition to family support, examinations regarding scale validity were carried out by Vallerand et al., (1992) Academic Motivation Scale (AMS) developed by Vallerand et al., (1989) and adapted into English. The scale was adapted into Turkish by Yurt and Bozer (2015). Consisting of seven graded items (1- non-compliant, 7- fully-compliant), the AMS involves seven factors, each of which has four items, as follows: Intrinsic Motivation to Know (IMTK), Intrinsic Motivation Toward Accomplishments (IMTS), Intrinsic Motivation to Experience Stimulation (IMTES), Extrinsic Motivation-Introjected Regulation (EMIR), Extrinsic Motivation- External Regulation (EMER), Identified Regulation (IR) and Amotivation (A). Receiving a high score in each sub-scale refers that the structure in that sub-scale has a high degree. The reason for using AMS as a criterion validity is that a positive relationship was determined between the perception of education value and academic motivation in the study carried out by Aliyev et al., (2021).

2.3. Data Collection

The items form was administered in the spring term of the 2019 – 2020 school year. EVPS and the family scale were administered to 84 secondary students in the classroom environment. 51 of the students were male and 33 of them were female. 33 of them were in the 5th grade, 20 in the 6th grade, 15 in the 7th grade and 16 in the 8th grade.

EVPS and AMS were administered to 96 secondary schools in the classroom environment. 51 of the students were male and 44 of them were female. 27 of them were in the 5th grade, 30 in the 6th grade, 21 in the 7th grade and 18 in the 8th grade.

In order to determine the stability of the developed EVPS, a test-retest administration was carried out. EVPS was administered to a total of 22 students (8th grade), 12 males and 10 females, with an interval of 20 days.

2.4. Data Analysis

It was seen that there was a 3.02% missing data The distribution of the missing data per substance, category and gender, their probability of occurring together were examined and no systematic pattern has been identified. The missing with the Missing Completely at Random mechanism were removed from the data set with the listwise method. In the remaining data, it was examined whether there were multivariate outliers. The results before and after the deduction of outliers were examined; it was observed that they were similar and that it is appropriate for them to be included in the data set in order to prevent the sample from getting smaller. Thus, it was decided to keep some of the determined outliers in the data set by assuming that they could be considered reasonable for samples of this size (Akbaş & Koğar, 2020). In order to specify the construct validity of EVPS, exploratory factor analysis (EFA) with R program and confirmatory factor analysis (CFA) were performed according to gender and grade level. In EFA, principal axis method, which allows factor extraction by analyzing the common variance, was used (Tabachnick & Fidell, 2013). The EFA and CFA estimates have been

calculated with polychoric correlation. The Unweighted Least Squares maximum likelihood method was utilized for the CFA estimates. CFA estimates have been conducted by using The Unweighted Least Squares method (Katsikatsou et al., 2012; Koğar & Yılmaz Koğar, 2015) with lavaan package (Rosseel, 2012). Prior to the analysis, the normal distribution hypothesis for CTT and one-dimensionality, local independence hyptoheses for the IRT were tested. Subsequently, the model data compliance for the IRT estimations were designated by pairwise comparison IRT analyzes were performed with the mirt package (Chalmers, 2012) of the R (R Core Team, 2020) program. While the interactions between hypotheses were being examined, when consistency and normality were ensued and the Pearson Moments correlation coefficient is not present, the Spearman's rank correlation coefficient was utilized

3. RESULT

Kaiser-Meyer-Olkin (KMO) value and Bartlett sphericity test analysis, which are preconditions for performing EFA on the collected data, were administered firstly according to whole data set, then only female and male students and finally grade levels. The EFA analysis were conducted by utilizing polychoric correlation matrix. The KMO value is .83 or higher for all data sets and the Bartlett's tests for sphericity are meaningful.

For various categories and sexes, it was observed that the determinant is positive, the VIF values are lower than 2, the tolerance values are higher than .5 and no multicollinearity problem is present. The correlation between the substances were examined with dispersion diagrams and it was observed that there is a linear correlation (Tabachnik & Fidell, 2013).

According to analysis results, it was identified that the eigenvalue of the 1st factor was 3 times the eigenvalue of the 2nd factor in all groups, when the scree plot was examined in all groups (Erkuş, 2016), there was a high decrease after the 1st factor, and all items had a high factor loading in the 1st factor (Büyüköztürk, 2018). Parallel analysis results also supported one factor result (Watkins, 2000). Based on these data, the scale was determined to have one dimension. As a result of the analysis, 11 items were removed due to cross loading and low factor loading, and it was seen that there were eight items with a factor loading above .32 (Tabachnick & Fidell, 2013). The factor loadings and corrected item-total correlations of the remaining items in the scale are shown in Table 2.

Table 2. *Factor loadings (λ) of items by groups and corrected item total correlations (rjx).*

	Total		Male		Female		8the grade		7th grade		6th grade		5th grade	
	λ	r_{jx}	λ	r_{jx}	λ	r_{jx}	λ	r_{jx}	λ	r_{jx}	λ	r_{jx}	λ	r_{jx}
I8	.76	.58	.75	.56	.76	.60	.78	.59	.82	.64	.69	.49	.70	.50
I6	.73	.55	.72	.53	.75	.57	.69	.49	.77	.60	.72	.52	.75	.57
I5	.73	.51	.69	.47	.76	.55	.73	.51	.67	.47	.70	.45	.78	.53
I9	.67	.49	.66	.46	.68	.51	.66	.47	.65	.47	.61	.41	.70	.51
I14	.65	.47	.62	.43	.68	.51	.61	.43	.67	.50	.66	.45	.63	.43
I12	.63	.46	.57	.44	.68	.49	.57	.43	.64	.46	.51	.40	.65	.41
I15	.66	.45	.63	.39	.68	.51	.62	.40	.64	.48	.61	.33	.63	.41
I2	.61	.42	.58	.39	.63	.44	.60	.40	.57	.39	.59	.38	.65	.44
	ω = .82		ω = .82		ω = .83		ω = .80		ω = .83		ω = .80		ω = .84	
	EV[1]= %46.3		EV= %43.0		EV= %49.6		EV= %43.4		EV= %46.4		EV= %41.0		EV= %47.4	

[1]EV, extracted variance

When examining Table 2, the factor loadings were between .57 and .82 for all groups. Item discrimination index varies between .33 and .64. Item discrimination index should be .30 and above (Crocker & Algina, 2008). The extracted variance ratio are between 41% and 49%. For a one factor scale, it is sufficient that the extracted variance rate is 30% or more (Büyüköztürk, 2018). Based on these data, it was observed that extracted variance ratio, factor loadings and item discrimination indexes were acceptable. The fit of the one factor model identified by EFA was tested CFA by using the data obtained from the second sample. For various categories and sexes, it is observed that the determinant is positive, the VIF values are lower than 2, the tolerance values are greater than .5 and there is no multicollinearity problem. The correlation between the substances were examined with dispersion diagram and that there is a linear correlation (Tabachnick & Fidell, 2013). The fit indices obtained as a result of CFA are provided in Table 3.

Table 3. *Confirmatory Factor Analysis results.*

		total	male	female	8th grade	7th grade	6th grade	5th grade
N		1445	711	734	401	314	389	341
χ^2		115.18	72.52	47.68	67.68	45.60	25.32	17.54
df		20	20	20	20	20	20	20
CFI	.90 ≤ good fit ≤ .95 ≤ perfect fit	.98	.97	.99	.96	.97	.99	1.00
TLI	.90 ≤ good fit ≤ .95 ≤ perfect fit	.97	.96	.98	.94	.96	.99	1.00
SRMR	perfect fit ≤ .05 ≤ good fit ≤ .08	.04	.05	.04	.06	.06	.04	.04
RMSEA	perfect fit ≤ .05 ≤ good fit ≤.08 ≤ poor fit ≤ .10	.06	.06	.07	.07	.06	.03	.00

When the values shown in Table 3 are compared with the limit values recommended in the literature (Browne & Cudeck, 1993; Moosburger & Müller, 2003; Schumacker & Lomax, 2004; Kline, 2016), it is seen that the CFI, TLI, SRMR and RMSEA values are in ranges of the limit values recommended literature.

The Composite Reliability (CR) and Average Variance Extracted (AVE) values calculated to determine the convergent validity of the structure confirmed by CFA analysis were given in Table 4.

Table 4. *Composite Reliability and Average Variance Extracted values.*

	CR	AVE
Total	.91	.56
male	.93	.62
female	.89	.51
8th grade	.91	.60
7th grade	.91	.63
6th grade	.90	.55
5th grade	.88	.45

When Table 4 is examined, it is seen that the CR values are greater than .70 and the AVE values are greater than .50, except for the 6th grades. These values show that convergent validity has been achieved (Hair et al., 2014).

3.1. Measurement Invariance

It was examined by multigroup confirmatory factor analysis (MCFA) whether the developed EVPS resulted in the same structure according to gender. The measurement invariance has four stages: configural invariance, metric invariance, scalar invariance and strict invariance (Meredith, 1993; Steenkamp & Baumgartner, 1998; Kline, 2016). If the CFI index obtained in different stages of MCFA is lower than |.01|, this shows that invariance is provided between stages (Cheung & Rensvold, 2002; Ho, 2006). Another value accepted as a criterion for measurement invariance is the SRMR value. The SRMR values being less than |.01| at each stage shows that measurement invariance has been achieved (Chen, 2007). MCFA results by gender are given in Table 5.

Table 5. *Multigroup Confirmatory Factor Analysis results by gender.*

Stages	χ^2	df	CFI	GFI	RMSEA	SRMR	ΔSRMR	ΔCFI
Configural Invariance	198.66	40	.921	.965	.052	.041	-	-
Metric Invariance	207.69	47	.920	.963	.049	.045	.004	.002
Scalar Invariance	207.82	48	.920	.963	.048	.047	.006	.002
Strict Invariance	221.82	56	.917	.960	.045	.050	.009	.005

It is shown in Table 5 that strict invariance was provided according to gender, measurements referred to the same structure for female and male students.

As a result of the CFA, the measurement invariance of the EVPS which was confirmed to be unidimensional, were tested in accordance with the grade levels. According to the invariance stages, it was seen that only the configural invariance was ensured. It was seen that ΔCFI and ΔSRMR levels are greater than .01 in the other stages.

3.2. Criterion-Related Validity and Stability

In order to examine the criterion-related validation of EVPS, the correlation calculated using the family support sub-scale of the Social Support Scale, was found to be highly positive relationship between scales (r = .43, $p < .01$). The Pearson Product-Moment Correlation Coefficients, calculated by the data obtained with the AMS used in the other examination for the criterion-related validity of the EVPS are given in Table 6.

Table 6. *Correlations between Education Value Perception Scale and Academic Motivation Scale.*

	x̄	df	IMTK	IMTS	IMTES	EMIR	EMER	IR	A	EVPS
IMTK	23.30	4.74		.60	.62	.45	.45	.60	-.29	.49
IMTS	21.97	5.09	.60		.67	.61	.54	.62	-.28	.46
IMTES	20.48	5.21	.62	.67		.51	.51	.62	-.27	.38
EMIR	19.46	6.06	.45	.61	.51		.58	.36	.00	.21
EMER	21.52	5.19	.45	.54	.51	.58		.49	-.81	.32
IR	24.67	4.57	.60	.62	.62	.36	.49		-.39	.42
A	6.43	4.12	-.29	-.28	-.27	.00	-.81	-.39		-.41
EVPS	24.89	5.02	.49	.46	.38	.21	.32	.42	-.41	

IMTK: Intrinsic Motivation to Know

IMTS: Intrinsic Motivation Toward Accomplishments

IMTES: Intrinsic Motivation to Experience Stimulation

EMIR: Extrinsic Motivation-Introjected Regulation

EMER: Extrinsic Motivation- External Regulation

IR: Identified Regulation

A: Amotivation

As it is seen in Table 6, there were positive correlations among EVPS with IMTK, IMTS, IMTES, EMIR, EMER, IR scores as expected, while there were negative correlations between EVPS and A scores as expected.

A test-retest administration was carried out for examining the stability of the data obtained by EVPS. It was observed that the correlation coefficient calculated by the data obtained from 22 students with an interval of 20 days was $\rho = .81$ ($p < .05$).

3.3. Model-Data Fit in IRT

For analyses regarding the IRT, in order to determine with which categorical model that the scale is in compliance, the model-data fit analysis was conducted with pairwise comparisons. The comparisons made between Graded Response Model (GRM) and Partial Credit Model (PCM) and Generalized Partial Credit Model are presented in Table 7.

Table 7. *Results of the Item Response Theory model comparisons.*

	AIC	AICc	SABIC	HQ	BIC	LL	χ^2	df	p
PCM	27228.44	27229.36	27280.92	27277.67	27360.34	-13589.22			
GRM	27098.97	27100.43	27166.14	27161.98	27267.79	-13517.48	72.603	0	0

Upon examining Table 7, it is observed that the AIC, BIC and logLikelihood values are lower in GRM and that the p value of χ statistic is meaningful signifies that the GRM model is more appropriate.

Table 8. *Results of the Item Response Theory model comparisons.*

	AIC	AICc	SABIC	HQ	BIC	LL	χ^2	*df*	*p*
GPCM	27171.57	27173.07	27238.74	27234.58	27340.40	-13553.78			
GRM	27098.97	27100.43	27166.14	27161.98	27267.79	-13517.48	72.603	0	0

Upon examining Table 8, it is observed that the AIC, BIC and logLikelihood values are lower in GRM and that the p value of χ statistic is meaningful signifies that the GRM model is more appropriate. As a result of pairwise comparisons, it was observed that the model best suitable for the data is the GRM.

In the fit of the data obtained by sample 2 in the model, firstly, the fit of each item in GRM was examined, which was followed by the examination of the fit of whole scale in GRM. In order to ensure model-data fit according to the items, RMSEA value should be less than .08, p significance value should be greater than .05 and the χ^2/df value should be below 3. The results obtained for GRM are provided in Table 9.

Table 9. *The fit of items in Graded Response Model.*

Statistics	I1	I2	I3	I4	I5	I6	I7	I8
χ^2	47.91	52.14	51.32	57.36	57.18	52.88	59.24	51.80
df	49	46	43	42	45	47	46	48
RMSEA	.00	.01	.01	.02	.01	.01	.01	.01
p	.52	.25	.18	.06	.11	.26	.10	.33

When Table 9 is examined, it is seen that all items fitted in the model ($p > .05$), RMSEA values were lower than .08 and χ^2/df ratio was lower than 3. When examining the model-fit of the whole scale, it is observed that CFI value was .95, NNFI value was .93, RMSEA value was .08, SRMSR value was .05. These findings show that model fit was provided.

The invariance of item parameters was tested by randomly dividing 1445 students into two groups to determine parameter invariance, and the invariance of ability parameters was tested by dividing 8 items into 2 groups. The correlation between the invariance of the b_1, b_2, b_3 item parameters which estimated according to the two groups was found to be positive excellent (ρ = 1.00, $p <. 05$), and the correlation between a parameters was found to be positive high (ρ = .92, $p < .01$). The relationship between abilities (θ) was found to be positive moderate level (r = .60, $p < .01$).

The item information functions obtained according to GRM are shown in Figure 1, and the test information function for the whole test is demonstrated in Figure 2. In Figure 2, it is seen that most information was provided between ability -2 and +1.5 in the scale.
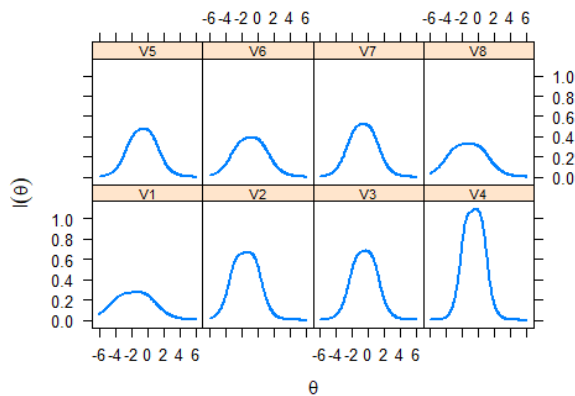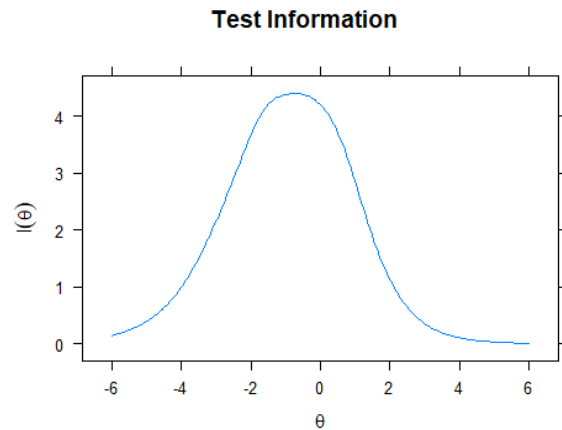
Figure 1. *Item information functions.*

Figure 2. *Test information functions.*

3.3. Examination of Measurements According to Different Test Theories

The relationship between the item discriminations estimated by the CTT and IRT of the EVPS was examined. Corrected item-total correlation coefficient according to CTT, and a parameter according to IRT were estimated. The findings related to estimation are given in Table 10.

Table 10. *Item discrimination indices.*

Items	CTT	IRT (a parameter)	SEa
1. Ailem, evde ders çalışmam için uygun bir ortam hazırlar. (My family prepares an appropriate environment for me to study at home.[*])	.36	.94	.08
2. Öğretmenlerim, eğitimimle ilgili beni yönlendirir. (My teachers guide me about my education.[*])	.45	1.49	.10
3. Ailem ve öğretmenlerim eğitimimi iyileştirmek için iş birliği yapar. (My family and my teachers collaborate to better my education.[*])	.50	1.49	.10
4. Derslerime giren öğretmenlerim, eğitimim için iş birliği yaparlar. (My teachers in my classroom collaborate for my education.[*])	.56	1.91	.12
5. Okul idaresi, ailemi eğitim faaliyetleri hakkında bilgilendirir. (School administration informs my family about educational activities.[*])	.46	1.24	.08
6. Okulumda yapılan sosyal etkinlikler, eğitim sürecime katkıda bulunur. (Social activities in my school contribute my education process.[*])	.43	1.12	.08
7. Ülkemde, iyi bir eğitim almam için fırsatlar sunulmaktadır. (Opportunities are provided to me to get a good education in my country.[*])	.48	1.30	.09
8. Bu eğitim sisteminde başarılı olabilirim. (I can be successful at this education system.[*])	.40	1.03	.08

[*] Unvalidated English translation

When examining Table 10, item discriminations range between .36 (2nd item) and .56 (8th item) according to CTT. According to the CTT, it is sufficient for an item discrimination of .30 and above (Büyüköztürk, 218). It is observed that a parameter changed between .94 (2nd item) and 1.91 (8th item) according to IRT. According to IRT, the distinctiveness of a parameter was specified to be very low between .01-.34, moderate between .35-.64, high between 1.35-1.69 and very high in 1.70 and above (Baker, 2001). The correlation between discriminations which tested according to CTT and IRT was found to be a highly positive significant ($\rho = .90$, *p* <. 05).

The relationship between the item means estimated according to the CTT and IRT was examined. Item means were determined by taking the average of the responses given by participants to categories according to the CTT. b parameter was estimated as one less than the number of categories according to the IRT. Three b-parameters were estimated, as the EVPS had four categories. The findings for the item means are shown in Table 11.

Table 11. *Item means rates.*

Item	CTT	*sd*	b1	SE	b2	SE	b3	SE
1	3.23	.03	-3.32	.25	-1.42	.12	-.16	.07
2	3.38	.02	-2.67	.16	-1.45	.09	-.35	.05
3	2.78	.03	-1.47	.08	-.40	.05	.57	.06
4	2.89	.03	-1.51	.08	-.50	.05	.39	.05
6	2.84	.03	-1.64	.10	-.50	.06	.46	.06
6	3.00	.03	-2.19	.14	-.89	.08	.32	.06
7	2.89	.03	-1.68	.10	-.62	.06	.41	.06
8	3.15	.03	-2.83	.20	-1.32	.10	.15	.06

When Table 11 is examined, it is seen that participants mostly reacted to high categories. The relationship between item means which estimated according to the both theories, was found to be negative high ($\rho = -.94$, *p* < .05). In CTT, as the difficulty increases, the item becomes easier. In IRT, on the other hand, it is the opposite. Therefore, the item means showed great similarity according to both theories.

The relationship between students' total score according to CTT and their perceptions of education value estimated by the Expected a Posteriori (EAP) method according to IRT was examined. EAP method enables to estimate θ levels of students, who had full score or the lowest score from the scale (Embretson & Reise, 2000). The relationship between students' perception of education value which estimated according to the both theories was found to be positive highly significant (r = .98, *p* < .01).

The McDonald's Omega level of internal consistency estimated according to the CTT of the scale was calculated as .79, and the marginal reliability coefficient estimated according to the IRT was calculated to be .77. Accordingly, it is seen that the reliability coefficients are considered satisfactory for measurement instruments used in education and psychology (Nunnally & Bernstein, 1994).

4. DISCUSSION and CONCLUSION

The EVPS that has been developed based on the Ecological Theory is a scale of eight items and represents four systems of the theory. Among the substances remaining in the scale, the 1st and the 2nd are related to the factors in the microsystem stage of the Ecological Hypothesis, the 3rd, the 4th and the 5th are related to the factors in the mesosystem stage, the 6th substance is related to the factors in exosystem stage. Therefore, the total score received from the scale is

able to unidimensionally present the perception of the student regarding education. Though they are not at the same educational stage, the scale developed by Aliyev et al. (2021) with the purpose of assessing the educational perspective of university students, is also unidimensional. Thus, the argument claiming that the educational value perspective in the Turkish culture is a unidimensional structure is further supported. Even if the items, which represent chronosystem level were written in the items form, they were not included in the final scale as they were identified to be inadequate as a result of EFA, and students were determined not to have perceived chronosystem level after examining their responses they gave to open ended questions. It was observed that strict invariance was provided in the measurement invariance of the EVPS according to gender. In this case, the scores to be obtained from the scale may be compared between groups. The reason for differences between groups will arise due to perceptions of education value.

When examining the item discriminations of the EVPS, it is seen that they are highly distinctive according to both CTT and IRT. It has been observed that there are high positive correlations between the parameters estimated according to different theories. The findings show similarity with the previous studies in this respect (Ferhan, 2018; Karakılıç, 2009; Köse, 2015; Nartgün, 2002; Uysal, 2015; Yaşar, 2019).

It has been achieved that EVPS can be used in studies not only based on CTT but also IRT. In this regard, ability estimations independent from sample can be made, and standard error can be calculated according to different ability levels. It enables to choose the most proper model to make more accurate estimations. It also allows to have detailed information by focusing on the responses to items. As it is likely to make probability estimations about how individuals will response to any item, it can be benefited from advantages of determining ability levels of individuals more accurately (Crocker & Algina, 2008; Hambleton et al., 1991).

Secondary school students' perceptions of education value can be measured by taking advantage of qualitative methods to eliminate the missing chronosystem level in EVPS. Although attention was paid to reach a heterogeneous study group at the development of the EVPS, city of Gaziantep takes places at lower side of education level. EVPS can be used in studies that are focused on comparing groups which have different educational levels. Changing of students' perceptions of education value can be examined through longitudinal studies.

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Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest. This research study complies with research publishing ethics. The scientific and legal responsibility for manuscripts published in IJATE belongs to the authors. **Ethics Committee Number:** Hasan Kalyoncu University/ Social Science Institution, 13-01-2020/02.

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Harun Dilek: Investigation, Resources, Methodology, Visualization, Software, Formal Analysis, and Writing -original draft. **Ufuk Akbas:** Investigation, Resources, Methodology, Visualization, Software, Formal Analysis, Writing -original draft, Supervision, and Validation.

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APPENDIX

Turkish Version of The Education Value Perception Scale

Eğitim Değeri Algısı Ölçeği	Bana Hiç Uygun Değil	Bana Biraz Uygun	Bana Büyük Ölçüde Uygun	Bana Tamamen Uygun
1. Ailem, evde ders çalışmam için uygun bir ortam hazırlar.				
2. Öğretmenlerim, eğitimimle ilgili beni yönlendirir.				
3. Ailem ve öğretmenlerim eğitimimi iyileştirmek için iş birliği yapar.				
4. Derslerime giren öğretmenlerim, eğitimim için iş birliği yaparlar.				
5. Okul idaresi, ailemi eğitim faaliyetleri hakkında bilgilendirir.				
6. Okulumda yapılan sosyal etkinlikler, eğitim sürecime katkıda bulunur.				
7. Ülkemde, iyi bir eğitim almam için fırsatlar sunulmaktadır.				
8. Bu eğitim sisteminde başarılı olabilirim.				