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# Cross-Cultural Adaptation and Validation of U.S. Test of Economic Literacy (TEL4) in Croatia

## Abstract

*The aim of this research was to adapt and validate US-based Test of Economic Literacy – 4<sup>th</sup> edition (TEL4) to Croatian cultural setting. Through adherence to guidelines prescribed by International Testing Committee and American Educational Research Association, original TEL4 test has been translated and validated through using direct one-way translation with multi-disciplinary committee assessment of both the original and translated version via focused group interviews and questionnaires. In the additional pilot study on 205 respondents, Rasch analysis was used to obtain further validity of the measure and item discrimination was calculated through Point-biserial correlations. The results of the data collected from multi-disciplinary committee assessment and the pilot study, indicate that the TEL4 in its' adapted form is a valid instrument to assess economic literacy in Croatia. Currently ongoing large-scale research into economic literacy by means of this adapted TEL4 test, on the representative sample in Croatia, will further validate the instrument. Practical implications of such validated instrument can support evidence-based policymaking related to economics education and curriculum development in Croatia. Limitations lie in cross-sectional design, which does not allow examination of changes over time. The pilot in which non-random convenience sampling is used, limits the generalization of this study. The article contributes to the body of literature on economic literacy as one of the important facets of*

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*modern economy and as such is the first study in systematic adaptation and validation of TEL4 test in Croatian setting by adherence to international translatory and adaptation standards and by Rasch analysis. Thus, this article scientifically contributes to the international field of methodological research on adaptation of economic literacy assessment instruments outside the US and Western Europe.*

**Keywords:** Economic literacy, Test of Economic Literacy (TEL4), Adaptation of test instruments, Rasch analysis

## 1. INTRODUCTION

Economic literacy has been found to be very important for the 21<sup>st</sup> century digital economies, characterized by knowledge workforce and the everchanging technological landscapes. It is one of the crucial literacies of the 21<sup>st</sup> century (Lemke, 2002). Economic literacy enhances digital economies, since through learning and studying economic concepts, one makes better personal choices, understanding influences of economic policies on individual lives (McCowage & Dwyer, 2022). It also increases country's human capital, bringing forth rising level of skills and knowledge crucial for the productivity of the workforce and economic competitiveness (Lemke, 2002). Being economically literate contributes to better civic engagement in economic matters in society, by informed participation and demand for accountability of economics' policymakers (Akhan, 2015). Research by Ingels & O'Brien (1985) showed that students with economics knowledge and education were more likely to support country's economic system and had greater belief in business life. Japelli (2010) has shown positive relationship between economic development, overall literacy and in particular, economic literacy. Economically developed countries scored better on PISA scores and measures of economic literacy. Thus, having economically literate population, enhances economic growth of country. Economically literate people know how economy works (e.g. they understand principles of monetary/fiscal policy, interest rates etc.) and can make more informed choices about their personal financial aspect, such as investing, buying house/flat, raising a loan. (Nizam, Sieng & Sulaiman, 2020; Walstad & Allgood, 1999).

Economic literacy has been widely researched and measured internationally (Weisandt & Abs, 2023) and especially in the US, where for more than 50 years, normed and validated tests were developed to measure economic literacy from early childhood until adulthood by the Council for Economic Education (CEE). These tests were culturally adopted and validated in many international settings and used accordingly (Weisandt & Abs, 2023). In Croatia, there exists a research gap, both in economic literacy measurement, and in translation, adaptation and

validation of an instrumentation for its measurement, which would allow for any further scientific large-scale research to be performed. Thus, this article aims to address the research gap with respect to translation, adaptation and validation of economic literacy instrumentation, which will enable currently ongoing large-scale research into economic literacy in Croatia.

This article will describe the adaptation and validation of scientifically well-known and researched, Test of economic literacy TEL4 to Croatia (Walstad, Rebeck & Butters, 2013a). The research goals were: (1) to adapt the TEL4 test linguistically and developmentally, (2) to determine the appropriate way to ensure item correction, (3) to establish the underlying structure of test, (4) to establish the internal consistency. These were necessary step as prescribed by the literature (ITC, 2017; AERA, 2014). Thus, this article scientifically contributes to the international field of methodological research on adaptation of economic literacy assessment instruments. Article first brings forth theoretical background into economic literacy and its' measures, followed by methodology outline and study results. Article ends with conclusion and theoretical and practical implications, together with limitations and future studies suggestions.

## 2. THEORETICAL BACKGROUND

Economic literacy has been defined as the ability to comprehend and interpret economic data in microeconomics e.g. bottom lines and expenses and macroeconomic e.g. public policies (Weisandt & Abs, 2023; As'ad & Zulfikar, 2020). It is the aptness to understand and make use of these principal economic concepts in everyday livelihoods (Reinhardt et al., 2021; Walstad, Rebeck & Butters, 2013a and 2013b). Economic literacy is connected to financial literacy. Despite potential overlap, there is a clear distinction between these concepts. Economic literacy deals with the overall understanding of economic postulates and concepts important for making informed financial decisions, while financial literacy is ability to apply economic postulates to individual financial decisions such as ones on borrowings and savings, budgeting and investing (for in-depth discussion and literature review see

for e.g. As'ad & Zulfikar 2020; Jappelli, 2010, Lussardi and Tufano, 2009). Economic literacy thus is the broader concept which engulfs the applicative portion of being financially literate.

### 2.1. Measurement of Economic Literacy

The most comprehensive measurement of economic literacy is done by the CEE and their variety of standardized tests of economic knowledge, starting from The Basic Economic Test – BET (Chizmar & Halinski, 1983) and Test of Economic Knowledge – TEK (Soper, 1979) for grades 4 to 9. Test of Economic Literacy -TEL (Soper, 1979) was developed for high-school economic knowledge assessment and Test of Understanding College Economics -TUCE (Saunders, Fels & Welsh, 1981) for the US student population testing. Other noteworthy instruments measuring economic literacy have also been researched (for literature review see Weisandt & Abs, 2023). Here we will mention German Test of minimal economic knowledge (Wobker et al., 2012) and IMD World Competitiveness Yearbook indicators (Japelli, 2010).

### 2.2. Test of Economic Literacy -TEL

TEL test, now in its fourth edition, was developed by the CEE to evaluate the economic comprehension of American high-school students. TEL4 has surpassed its original usage, and is used to assess economic knowledge in other settings, such as with students and adults (for the review of literature see e.g. Weisandt & Abs, 2023). With respect to students, prolific research with the validated and adapted TEL4 test has been done in Germany. Reinhardt et al. (2021) assessed prior knowledge of incoming international students to Germany, where refugees scored higher than other international students, probably due to their maturity. Happ, Kato & Ruter (2021) used it to assess gender differences on the sample of German and Japanese business students, where gender effect was only found prevalent in Germany. Noteworthy is Indian research of MBA students' economic literacy by Koshal et al. (2008), where it was found that their economic knowledge was quite poor, especially in macroeconomics. TEL4 was used in various economic literacy research in

Malaysian universities. Economic literacy was impacted by socioeconomic factors and was found higher with participants having higher household incomes (Nizam, Sieng & Sulaiman, 2020) and educational background in economics (Harsoyo, Saptono & Purwanta, 2017). With respect to adults, TEL was used with teachers. Economic literacy was higher with teachers teaching stand-alone economics (Bosshardt & Watts, 1990) and those who had more economic courses during their education (Grimes, Millea & Thomas, 2010). Having structured economics training provided by the CEE increased the economic literacy of educators in Russia (Grimes & Millea, 2011), Lithuania, Ukraine, Kyrgyzstan and Poland (Walstad & Rebeck, 2001). Gleason & Van Scyoc (1995) administered TEL to 942 US adults, where it was found that life experience, age and having economics educational background increased economic literacy.

TEL4 comes in two forms (A and B), each with 45 multiple-choice questions on an economic situation, with only one correct answer out of four provided. Two versions are connected to one another by 10 uniform anchor items. Forms A and B constitute the quintessence of economic literacy as prescribed in the Standards and are classified according to Bloom taxonomy. (Walstad, Rebeck & Butters, 2013a and 2013b). Key concepts tested in TEL4 are related to microeconomics (e.g. scarcity, marginal analysis, price, wages, allocation systems, markets, supply and demand) and macroeconomics (e.g. labor markets, money, inflation, employment, output). Forms A and B are used interchangeably, for pre-test and post-test purposes, however if test is submitted at the beginning and end of semester, only one form of test can also be used (Walstad, Rebeck & Butters, 2013a and 2013b).

### 2.3. Economic Literacy Measurement in Croatia

Economic literacy in Croatia has seldomly been tested. Research by Japelli (2010) through IMD World Competitiveness Yearbook methodology and international panel data from 1995 to 2008, positioned Croatia as that of average economic literacy with score 3, similar to other former socialists' countries. Erceg, Galić & Bubić (2018),

developed and adapted metrics which tested economic attitudes, socio-demographic, psychological variables and importance of morality. Economic attitudes were influenced by psychological variables, and economic concerns were proven in its' essence to be both economic and moral.

CEE-based testing of economic literacy was done twice and as a part of their teachers' training programs assessments. In 2006 TUCE-based testing with 10 Croatian educators out of 700 from former USSR and Central and Eastern Europe was pre and post-tested after passing economics' training programs and compared with US students. Data were not country specific, but results show better economic literacy of teachers compared to students, both in pre and post-testing results (Scahill, 2006).

TEL in Croatia was used in the international research on five Eastern European/Baltic countries by Saunders, Rebeck & Saunders (2004), where educators and organizers participating in CEE workshop, compiled, translated and administered 20 TEL3 items, in their designated countries. In Croatia, 6 vocational secondary school of business and commerce were involved from 4 cities, with 9 teachers and 178 high-school students tested. Content validity was assessed by asking 9 teachers to assess the TEL version of test related to their teaching course contents, which they found to be very similar. Students obtained average 11.11 score. Economic literacy was higher with students who had either higher prior exposure to economics, and/or teachers with more economic subjects taken.

Thus, there exists a research gap with respect to thorough translation and adaptation of TEL test to Croatia and large-scale research into economic literacy. This article addresses the gap with respect to translation and adaptation of TEL test to Croatia.

### 3. METHODOLOGY

To align with study goals, mixed - method design, combining qualitative and quantitative methods was used (Ghauri, Gronhaug & Strange, 2020; Creswell, 2015; Mejovšek, 2013).

Cross-cultural test translation research indicates that such designs are common, and translation guidelines recommend them (Forster, Zlatkin-Troitschanskaia & Happ, 2015).

Adaptation adhered to the International Test Commission Guidelines for Translating and Adapting Tests (ITC, 2017) regarded as an important code of conduct (Tanzer & Sim, 1999, p.258). Moreover, American Educational Research Association Standards for Educational and Psychological Testing (AERA, 2014) was consulted as a blueprint for validation and reliability guidance (McGill, Ward & Canivez, 2020). Relevant literature, including the Cross-Cultural Survey Guidelines (Mohler et al., 2016) was examined and consulted.

The research question was: Is TEL4 test valid and reliable measure of economic literacy in Croatia?

The adaptation and validation of TEL4 test, following written permission from CEE, was done in several stages:

#### 1. Content validity assessment

Purpose was to make sure that the TEL4 measured constructs in its items were culturally and linguistically valid in both Croatian and the US context (ITC, 2017). Method used was semi-structured questionnaire accompanied by follow-up focused group interview with four university-level economics lecturers, with economics' teaching experience in English and Croatian. Both TEL4 form (A and B) with accompanying materials were evaluated to answer: *Is the construct contextually meaningful in both cultures?* (ITC, 2017, p.9)

#### 2. Translation process

A direct one-way ("one-for-one") translation method (McKay et al., 1994) was chosen, coupled with a multi-disciplinary committee evaluation (Harkness, Villar & Edwards, 2010; Harkness & Schoua-Glusberg, 1998). Direct translation is time and cost-efficient but may reflect translator's subjectivity and overlook regional differences (Harkness & Schoua-Glusberg, 1998). Thus, committee evaluations are important,

even more so than the back-translation (Epstein et al., 2015).

Expert committee included: The translator (corresponding author, university lecture with over 10 years of experience teaching economics in both Croatian and English), a Croatian-English linguist/translator, a psychometric assessment expert and a university-level economics lecturer.

Items were assessed using an adapted translation rating scale (Hambleton & Zenisky, 2011), consistent with AERA guideline 1.9: „systematic collection of judgments may be used at various points to elicit expert judgment on content appropriateness or content representation.“ (AERA, 2014, p.21)

### 3. Pilot study

A pilot study of the adapted test was conducted to “enable item analysis, reliability assessment and small-scale validity studies so that any necessary revisions to the adapted test can be made.” (ITC, 2017, p.15).

Data analysis included:

- Calculating response frequencies and item difficulty indices
- Item discrimination through point-biserial correlations (Violato, 2019).
- Rasch analysis (Boone & Noltemeyer, 2017) to establish the internal structure of the test, following inadequate factor analysis results. This study yielded results which have shown one-dimensional structure of economic knowledge tested, aligning with Forster, Zlatkin-Troitschanskaia & Happ (2015).<sup>1</sup>

<sup>1</sup> Factor analysis performed investigated the structure of the TEL. Despite Bartlett sphericity test ( $\chi^2(780) = 1534.24, p < .001$ ) and KMO (.71) indicating that data was appropriate for performing factor analysis, a simple solution was impossible, since most items had low loadings with extracted factors (thus should be withdrawn from a factor solution). There was a high presence of cross loadings and factor analytical models accounted for low percentages of variance explained (<50%).

A non-probability sampling, method frequently used in pilot studies, was utilized (Ghauri, Gronhaug & Strange, 2020; Mejovšek, 2013). The adopted version of the TEL4 questionnaire was given to a sample of 205 students and staff from a private university and polytechnic, both also offering adult education. Due to lack of time and other resources, research was focused on participants and staff from these two institutions. To ensure diversity and increase generalizability, alongside university staff, we sampled students from various programs (IT, Digital marketing, Economics and Law, Design). Also, since both institutions offer adult educational programs, this enabled us to choose the sample which will most closely resemble the chosen target population for the large-scale study (18-79 years old participants). TEL4 is originally comprised of form A and B, however, norming performed internationally and, in the USA, revealed that both forms cover similar content. Furthermore, extensive pre-testing and post-testing of students was also done using only one form (Walstad, Rebeck & Butters, 2013a). Thus form A was chosen.

The questionnaire measured economic literacy and other factors (gender, age, educational and socio-economic variables). Data collection (January-March 2024) was classroom based, pen and paper method. Participant confidentiality and anonymity was secured; informed consent was obtained together with the institutional approval. A sample of questions is given in the Appendix, Table 1A.

Analyses in Jamovi v.2.4, followed ITC criteria for test adaptation, item analysis, reliability and validity evaluation. Item difficulty was the proportion of correct responses, with the best value (0.625) obtained for four-option questions. Response frequency identified problematic distractors. Under the assumption of unidimensional testing, Rasch analysis evaluated item fit and scale reliability, with infit and outfit statistics (acceptable range: 0.70–1.30) and model dependability between individualized items (Boone & Noltemeyer, 2017). Point-biserial correlations provided discrimination indices for each TEL4 item.

## 4. RESULTS AND DISCUSSION

### 4.1. Validation of the Test

The results of content validity assessment were obtained through a questionnaire and a synchronous virtual focused group interview (Barbour, 2007). The expert participants were not randomly chosen but invited, to enable wider and more elaborate contribution to the topic of discussion. This also ensured better motivation and decreased risks of denial and self-selection (Corrao, 2000 as quoted in Acoccella & Cataldi, 2021, p.124). Before the virtual focused group interview on Microsoft Teams platform, experts were provided with abridged English version of the Test of Economic Literacy Examiner's manual (4<sup>th</sup> edition) (Walstad, Rebeck & Butters, 2013a), together with a semi-structure questionnaire. Experts evaluated how well the test measured knowledge, understanding, and application of economic data related to variety of test given constructs and in the Croatian cultural context on a 5-point Likert scale. The response options were: 1 – Strongly disagree 2 – Disagree 3 – Neither agree nor disagree 4 – Agree 5 – Strongly agree.

All experts' participants (N=4) had an economics education at levels 7.1 under the Croatian Qualifications Framework (CROQF). They have been lecturers in one or more economic subjects at university levels for the periods ranging from 5 to 20 years. They also taught university economic subjects in English. In qualitative research, it is, for offline contexts, advisable to recruit 8 to 12 participants to balance diversity and limit the risk of few individuals dominating, while for online contexts, it is 8 participants and one moderator maximum (Stewart & Shamdani, 2015). Barbour (2007) argues that small groups of 3 to 4 participants are also workable, particularly when the intent is to differentiate and explore varying individual perspectives, as larger groups are more difficult to manage and analyze.

For majority of proposed constructs, the participants concurred that they measured economic knowledge, understanding and application. Agreement among experts was lower for five constructs: decision-making, marginal analysis;

markets and prices, economic institutions, entrepreneurship and government failure.

The 1-hour focused group interview with the moderator<sup>2</sup>, evaluated further the fit and necessity to modify the measurement to Croatian culture. A recommendation was made to exclude questions 9,18,20,22,33 since they did not fall within Croatian socio-economic contexts. The summary of participants' feedback on the entire test showed that it was perceived as versatile and comprehensive. However, it also exhibited the common drawbacks of the test based on multiple-choice questions, and some needed to be adapted to the Croatian context. Table 2A in the Appendix illustrates some of the excluded questions.

### 4.2. Translation and Adaptation

Both forms of TEL4 questionnaire were translated by the corresponding author. Translation was done in accordance with the International Testing Commission (ITC) and Cross-Cultural Survey (Mohler et al., 2016) guidelines. Psychometric equivalence was achieved using a sequential procedure. The principal strategy was to use the "ask-the-same-question" technique. It minimized content amendment and allowed for preservation of psychometric properties (Mohler et al., 2016; Harkness, Villar & Edwards, 2010). However, the "ask-a-different-question" technique was deployed selectively and in cases where the original content was deemed culturally unfitting for the Croatian context (Harkness, Villar & Edwards, 2010). Response options were translated with the maximum fidelity possible with respect to wording, order, and structure, taking into consideration their effect on participant responses (Harkness & Schoua-Glusberg, 1998). Nevertheless, slight complexity adjustments were performed to align with the norms of written Croatian. For example, some domain-specific terminology with respect to macroeconomic instrumentation were adapted to better mirror the Croatian context (e.g. the US Federal Reserve was changed to European Central Bank because Croatia is a member of the euro-zone).

<sup>2</sup> Moderator was the corresponding author.

The translation was appraised by the committee of experts using the adapted review form by Hambleton & Zenisky (2011). The group members contrasted each original item with the translated one. The evaluation of the items considered the following: the equivalence and comparable difficulty in both languages; the equivalence of item format in both languages; cultural adjustability, familiarity, usage of the pertinent conventions of the target language. There were four possible answers for each question asked: Yes, No, Not sure, Not relevant.

After reviewing the data and performing additional consultations, 5 items were removed by the experts since they assessed them as not suited to the language and/or cultural context, which coincided with the suggestions from the first expert evaluation of content validity of the test.

Overall findings from committee assessments have found this test as suitable for Croatian cultural setting. Although this is a US-based test in economic literacy and it is important to recognize the differences in economic and social conditions in different countries (Wobker et al., 2012), the spread of globalized economics knowledge worldwide is noteworthy. Many American economics books have for decades been used as a standard literature at universities in Western economies (Lopus & Paringer, 2011), including Croatia (e.g. Economics by Samuelson and Nordhaus and Principles of Economics by Mankiw, are widely accepted as standard references and in many cases obligatory university reading). Also, TEL4 is a multiple-choice test, with standard shortcomings of such instrumentations as representing retrieval of factual/definitional knowledge rather than knowledge utilization. However, such form is very often used in testing of economic knowledge (Weisandt & Abs, 2023). Therefore, validation efforts through committee assessments have deemed adapted TEL4 test suitable for usage in Croatian setting.

### 4.3. Pilot Study

#### Descriptive statistics

The pilot study was done using 40 TEL4 questions from group A. It included 205 respondents

living in 17 counties of the Republic of Croatia (the largest number was from the City of Zagreb - 65%); participation of females was slightly higher (61%) than males (39%). The largest proportion of respondents have completed high school education (74%), followed by those with completed undergraduate, graduate, and post-graduate studies (24%), and 1% of respondents with completed primary education. Largest proportion of respondents had previously finished a gymnasium program (32%) and programs in the field of business and trade (20%).

A significant portion of respondents (63%) evaluated their success in previous education as average. The predominant number of respondents were enrolled in education (54%), followed by those who were employed (30%), and those who were both working and studying (10%). The largest number of respondents presently lived with their parents/guardians/caretakers (45%), 31% lived in their own accommodation or in a partner's accommodation, and 22% were tenants. 56% of respondents reported monthly household income higher than 1327 euros, 18% said that their household income spanned from 796 to 1327 euros, while 18% were uncertain about their household income. Predominant number of respondents lived in households from 3 to 5 members, 30% of respondents lived in households consisting of 1 to 2 members, while 4% lived in households having more than 5 members.

Considering the level of education of parents, 51% of fathers and 46% of mothers, completed high school/secondary education. That was followed by 42% of mothers and 35% of fathers who completed higher education. 25% of respondents stated that during their former education, they did not have any subjects/courses in economics.

#### Item level analysis

Table 1 shows key findings related to TEL4 response frequencies, percentages and item difficulties. This research has found that in majority of items correct answer was the one with highest response frequency. For example, TEL4 8, was found to be the easiest item - 88% respondents answered correctly, similar to TEL4 7, with 84%

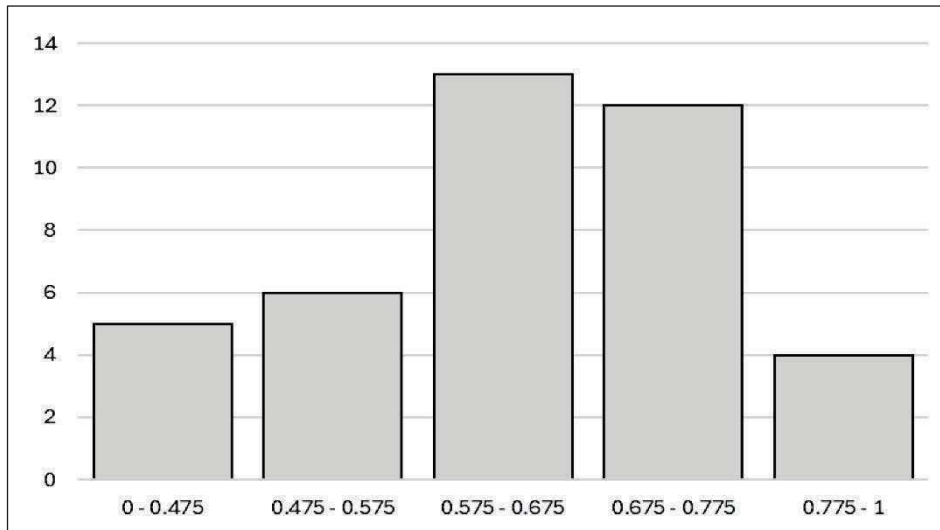
**Table 1.** Selected Key Findings on TEL4 Frequencies and Percentages of Responses, Together with Item Difficulties

		Response				Difficulty
		a	B	C	d	D
TEL4 4	f	9	24	80	92	0.44
	%	4 %	12 %	39 %	45 %	
TEL4 7	f	172	10	8	15	0.85
	%	84 %	5 %	4 %	7 %	
TEL4 8	f	13	9	180	3	0.88
	%	6 %	4 %	88 %	1 %	
TEL4 10	f	12	120	14	59	0.59
	%	6 %	59 %	7 %	29 %	
TEL4 11	f	98	55	17	35	0.48
	%	48 %	27 %	8 %	17 %	
TEL4 15	f	54	69	39	43	0.34
	%	26 %	34 %	19 %	21 %	
TEL4 18	f	84	10	30	81	0.4
	%	41 %	5 %	15 %	40 %	
	%	10 %	16 %	63 %	11 %	
TEL4 34	f	39	35	35	96	0.47
	%	19 %	17 %	17 %	47 %	
TEL4 35	f	17	43	122	23	0.6
	%	8 %	21 %	60 %	11 %	

Source: Authors

or respondents answering correctly. The research has revealed several examples where one or more wrong answers showed larger response frequency than anticipated, e.g. TEL4 4, where 39% of respondents chose answer 'c'. With item TEL4 10, 29% of respondents chose answer 'd'. Item TEL4 15, was the most difficult one, with only 34% of correct answers, and with wrong responses evenly distributed with respect to distractors (26%, 19% and 21%). Item TEL4 18 was the only one where incorrect answering (a, 41%) surpassed the correct responses (d, 40%).

For other items no obvious pattern of giving wrong answers was noticed. Graph 1. represents the histogram of TEL4's items difficulties. With respect to four response test items, the optimal calculated difficulty was 0.625. Looking at the interval of 10% around optimal difficulty of 0.575-0.625, the research has revealed that most items (13, 32.5%) have near optimal difficulty. There were 6 items (15%) characterized as somewhat more difficult, in the range 0.475 - 0.575, and 5 (12.5%) items characterized as the most difficult ones, with interval of less than

**Graph 1.** Distribution of Difficulties of Items in TEL4

Source: Authors

0.475. Within the range of 0.675-0.775, categorized as somewhat easier, there were 12 items (30%). There were 4 items (10%) which could be considered to be the easiest, where item difficulty was greater than 0.775. This distribution of difficulties suggests that this test is of appropriate difficulty, with most items near an appropriate level of difficulty, and both hard and easy items next to them.

#### Rasch analysis of the TEL4

Furthermore, TEL4 items were consequently fitted with the Rasch model. Findings revealed person reliability, which represents the overall model fit, to be 0.81 ( $p = 0.02$ ), indicating that data represent a good fit to the Rasch model. Key Rasch analysis results are presented in the Table 2. Most items are well fitted for Rasch analysis, with values within the 0.70-1.30 interval (perfect fit is obtained at value 1 of infit and outfit results). Column one, Proportions reveals difficulties of each item. Subsequent two columns represent the position of each item on the scale of a latent trait measured by the TEL4, together with its standard error. Final two columns show a fit of items to the Rasch model. Majority of items are within a close fit to the Rasch mod-

el. For example, TEL4 7, the easiest item with a difficulty level of 0.85 and consequently high proportion of respondents answering it correctly, lied far to the left of latent trait scale (-1.92), which is the indication of it being well-suited for respondents with lower economic literacy, and falling adequately to model fit (infit 0.97; outfit 0.9), suggesting that item measured the construct intended and fit the Rasch model well. Similar could be said for TEL4 8, the easiest item on the test (latent trait value of -2.18; infit of 0.93 and outfit 0.76), aligned well within Rasch model, and could be seen as a baseline for identification of participants with minimum economic literacy. TEL4 15 was the most difficult question, with proportion of correct answers only of 34%, with latent trait of 0.77 positioning it as measuring individuals with solid and proficiency levels of economic literacy, with good fit indices (infit 1.07 and outfit 1.18). Two outliers were found, namely items TEL4 34 (proportion = 0.47; latent trait = 11.63) and TEL4 35 (proportion = 0.60; latent trait = -5.34), with outfit values greater than 4, which is a clear indication that they should be excluded from the total test score.

Point-biserial correlation coefficient between individual item and total TEL4 score, was used as

**Table 2.** Selected Key Results of Rasch Analysis of TEL4 Items

	Proportion	Measure	S.E. Measure	Infit	Outfit
TEL4 7	0.85	-1.92	0.2	0.97	0.9
TEL4 8	0.88	-2.18	0.22	0.93	0.76
TEL4 15	0.34	0.77	0.16	1.07	1.18
TEL4 34	0.47	11.63	1.02	1.11	4.67
TEL4 35	0.6	-5.34	1.02	1.11	4.70
Note. Infit= Information-weighted mean square statistic; Outfit= Outlier-sensitive means square statistic.					

Source: Authors

the measure of item discrimination. The data revealed that all items had positive and statistically significant relation to the overall test score with mean point-biserial correlation of 0.34, which implicates good and robust item discrimination properties of the overall test. The key findings illustrating high-performing (TEL4 24, TEL4 21, TEL4 31, with  $r > 0.48$ ) and low-performing items (TEL4 15, TEL4 18, TEL4 30 with  $r \leq 21$ ) as representative of discrimination variability within the test itself, are presented in Table 3.

**Table 3.** Selected Key Results of Point-Biserial Correlation Analysis

Item	TEL4 total
TEL4 15	0.21**
TEL4 18	0.21**
TEL4 21	0.52***
TEL4 24	0.54***
TEL4 30	0.18**
TEL4 31	0.48***
Note. * $p < .05$ , ** $p < .01$ , *** $p < .001$	

Source: Authors

The results clearly indicate that adapted TEL4 test is a reliable and valid instrument for usage in Croatian setting, as shown through Rasch

analysis and point-biserial correlations. Five questions were excluded in content validity assessment, and the remaining 40 questions have in pilot study shown optimal numbers of difficult, medium and least difficult questions. Therefore, they can be used for large-scale examinations of economic literacy. This is in line with research on economic achievement test adaptation and validation, where similar methodology was used to validate the instrument (Sary & Yin, 2021).

## 5. CONCLUSION

The evidence provided through the expert interviews showed that the content standards of economic literacy as prescribed by the CEE (2010) and evaluated economic content areas of the TEL4 test were pertinent for use in Croatia. Certain items on the TEL4 were adjusted to the Croatian context and Rasch analysis showed that the test was a valid measure, suitable instrument in differing respondents with various economic literacy levels. Items' difficulty was appropriate, and all items correlated positively and significantly with the total score. This is the first study in systematic adaptation and validation of TEL4 test in Croatian setting by adherence to international cross-cultural translatory guidelines and by means of Rasch analysis. Thus, this article scientifically contributes to the international field of methodological research on cross-cultural adaptation of economic literacy assessment instruments by bringing

in insights from Croatian scholarly experts and through usage of Rasch analysis as a method of validation. Moreover, pilot study into economic literacy in Croatia, although used for purpose of enhancing validity and reliability, has provided insights into the current state of economic literacy within the chosen population.

This all forms a basis for currently ongoing large-scale research into economic literacy on the representative sample in Croatia with this adapted TEL4, which will provide further scientific research insights. Therefore, this will further extend the scientific contribution to the research of economic literacy assessment outside the US and Western Europe. Future international large-scale comparisons into economic literacy could provide further insights into economic literacy assessment which could serve as basis for scholars, educators and policymakers to enhance economics competences in various socio-cultural contexts. By having instrument with established cross-cultural measurement equivalence, practical benchmarks in the international context can be examined. Future research can also focus on establishing economic literacy predictive models in Croatia. Such large-scale research into predictive models of economic literacy determinants were already done in the US (Walstad, 1997) and Germany (Wobker et al., 2012) with both scholarly and also practical implications serving to support evidence-based policymaking related to economics education and curriculum development.

Study limitations arise from cross-sectional design usage, which does not allow investigation of changes over time. Also, the pilot in which non-random convenience sampling is used limits the generalization of the study. Further validations through large-scale research on the representative sample in Croatia are going to be made, through scientific rigor with respect to sampling, data collection and statistical instrumentation used.

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## APPENDIX

**Table 1A.** TEL4 Test – Excerpts of the Questionnaire in English and Croatian

<p><i>4. From an economic point of view, which approach to controlling pollution is most efficient?</i></p> <p><i>A. Abolish the use of toxic chemicals in all production.</i></p> <p><i>B. Use economic resources to eliminate all pollution.</i></p> <p><i>C. Adopt laws and regulations that prohibit economic activities that cause pollution problems.</i></p> <p><i>D. Reduce pollution as long as the additional benefits are greater than the additional costs.</i></p> <p><i>4. S ekonomskog gledišta, koji pristup kontroli zagađenja je najefikasniji?</i></p> <p><i>A. Ukidanje korištenja opasnih kemikalija u svim proizvodnim aktivnostima.</i></p> <p><i>B. Korištenje ekonomskih resursa kako bi se u potpunosti uklonilo zagađenje.</i></p> <p><i>C. Usvajanje zakona i regulativa kojima se zabranjuju ekonomske aktivnosti koje uzrokuju probleme sa zagađenjem.</i></p> <p><i>D. Smanjivanje zagađenja sve dok su dodatne koristi od toga veće nego dodatni troškovi.</i></p>
<p><i>7. Profits are equal to total</i></p> <p><i>A. revenue minus total cost.</i></p> <p><i>B. assets minus total liabilities.</i></p> <p><i>C. sales minus wages and salaries.</i></p> <p><i>D. sales minus taxes and depreciation.</i></p> <p><i>7. Dobit je jednaka ukupnom iznosu</i></p> <p><i>A. prihoda umanjenog za ukupni trošak.</i></p> <p><i>B. imovine umanjene za ukupne obveze.</i></p> <p><i>C. prodaje umanjene za plaće i naknade.</i></p> <p><i>D. prodaje umanjene za poreze i amortizaciju.</i></p>
<p><i>8. If the government decides to reduce the payroll taxes on the wages and salaries of workers, then there will most likely be</i></p> <p><i>A. a decrease in saving.</i></p> <p><i>B. a decrease in investment.</i></p> <p><i>C. an increase in consumption.</i></p> <p><i>D. an increase in unemployment.</i></p> <p><i>8. Ako vlada odluči smanjiti porez na dohodak, to će najvjerojatnije dovesti do</i></p> <p><i>A. smanjenja štednje.</i></p> <p><i>B. smanjenja investicija.</i></p> <p><i>C. povećanja potrošnje.</i></p> <p><i>D. povećanja nezaposlenosti.</i></p>
<p><i>10. Specialization and division of labor by nations followed by increasing international trade probably would (TEL4 ORIGINAL Q11)</i></p> <p><i>A. increase the level of worldwide unemployment.</i></p> <p><i>B. increase total world production of goods and services.</i></p> <p><i>C. lower living standards in the poor nations of the world.</i></p> <p><i>D. eliminate differences in standards of living among nations.</i></p> <p><i>10. Specijalizacija i podjela rada u svijetu praćena povećanjem međunarodne trgovine, najvjerojatnije bi dovela do</i></p> <p><i>A. povećanja nezaposlenosti širom svijeta.</i></p> <p><i>B. povećanja ukupne svjetske proizvodnje dobara i usluga.</i></p> <p><i>C. smanjenja životnog standarda u siromašnijim zemljama svijeta.</i></p> <p><i>D. uklanjanja razlika u životnim standardima između različitih zemalja.</i></p>

15. Which would most likely increase the quantity of gasoline sold in a competitive market?

- A. An increase in the price of crude oil.
- B. A decrease in the price of automobiles.
- C. A decrease in the income of consumers.
- D. An increase in taxes on gasoline products.

15. Koje od navedenog bi na slobodnom tržištu najvjerojatnije utjecalo na povećanje ponuđene količine benzina?

- A. Povećanje cijene sirove nafte.
- B. Smanjenje cijena automobila.
- C. Smanjenje dohotka u potrošača.
- D. Povećanje trošarina na benzin.

18. Which characteristic makes the most positive contribution to people's incentive to produce and exchange goods and services in a market economy? (TEL 4 ORIGINAL Q21)

- A. An equal distribution of income.
- B. Controls on the supply of gold.
- C. Restrictions on consumer choice.
- D. The right to own private property.

18. Što od navedenog najviše potiče ljude na proizvodnju i razmjenu dobara u tržišnoj ekonomiji?

- A. Jednaka raspodjela dohotka.
- B. Kontrola ponude zlata.
- C. Ograničavanje izbora potrošača.
- D. Pravo na posjedovanje privatne imovine.

34. An economy's potential output at any time is limited by (TEL4 ORIGINAL Q39)

- A. the amount of money in circulation.
- B. government regulations and spending.
- C. business demand for final goods and services.
- D. the quantity and quality of labor, capital, and natural resources.

34. Potencijalna proizvodnja nekog gospodarstva u nekom vremenskom periodu ograničena je

- A. količinom novca u optjecaju.
- B. državnom regulacijom i potrošnjom.
- C. potražnjom firmi za finalnim proizvodima i uslugama.
- D. količinom i kvalitetom rada, kapitala i prirodnih resursa nekog.

35. Which would usually reduce total spending in the economy? (TEL4 ORIGINAL Q40)

- A. A fall in interest rates.
- B. A decrease in business taxes.
- C. A decline in consumer incomes.
- D. A reduction in personal income tax rates.

35. Što od navedenoga bi uobičajeno smanjilo ukupnu potrošnju nekog gospodarstva?

- A. Pad kamatnih stopa.
- B. Smanjenje poreza u poslovanju.
- C. Smanjenje dohodaka potrošača.
- D. Smanjenje stopa poreza na osobni dohodak.

Source: Authors' adaptation from Walstad, B.W., Rebeck, K. & Butters, R.B. (2013a). Test of economic literacy: Examiner's manual (4th ed.). New York: Council for Economic Education. [http://www.c3teachers.org/wp-content/uploads/2016/09/Walstad\\_Rebeck.pdf](http://www.c3teachers.org/wp-content/uploads/2016/09/Walstad_Rebeck.pdf)

**Table 2A.** Excerpt of the Questions Removed from the Original TEL4 Test – Form A

<p>9. A high school student buys a sweatshirt from a store. The sweatshirt is on sale at a 20 percent discount off the regular price. In this exchange, A. the student and the store benefit. B. the student benefits, but the store does not. C. the store benefits, but the student does not. D. neither the student nor the store benefits.</p> <p>9. Srednjoškolar kupi majicu u dućanu. Majica je na 20%-om popustu na redovnu cijenu. U ovoj razmjeni A. i srednjoškolar i trgovina ostvaruju korist. B. srednjoškolar ostvaruje korist ali trgovina ne. C. trgovina ostvaruje korist ali srednjoškolar ne. D. ni srednjoškolar niti trgovina ne ostvaruju korist</p>
<p>33. Government rather than private business provides national defense because A. it is a benefit and not a cost. B. it is a cost and not a benefit. C. not all who benefit from it would pay for it. D. if some benefit from it, less is available for others.</p> <p>33. Nacionalnu obranu pružaju vlade a ne privatne kompanije zato što A. je to korist i ne predstavlja trošak. B. je to trošak ali ne predstavlja korist. C. ne bi svi koji imaju koristi od toga platili za to. D. ako neki imaju korist od toga, drugima je manje dostupno.</p>

Source: Authors' adaptation from Walstad, B.W., Rebeck, K. & Butters, R.B. (2013a). Test of economic literacy: Examiner's manual (4th ed.). New York: Council for Economic Education. [http://www.c3teachers.org/wp-content/uploads/2016/09/Walstad\\_Rebeck.pdf](http://www.c3teachers.org/wp-content/uploads/2016/09/Walstad_Rebeck.pdf)

## Međukulturna prilagodba i validacija američkog Testa ekonomske pismenosti (TEL4) u Hrvatskoj

### Sažetak

Cilj istraživanja je bio prilagoditi i validirati američki Test ekonomske pismenosti – 4. izdanje (TEL4) hrvatskom kulturološkom okruženju. Prema smjernicama Međunarodnog odbora za testiranje i Američkog udruženja za obrazovna istraživanja, originalni TEL4 test preveden je i validiran metodom izravnog jednosmjernog prevođenja uz procjenu multidisciplinarnih komisija, koje su kroz upitnik i metodu fokus grupe ocijenili originalni test i njegov prijevod na hrvatski. U dodatnoj pilot studiji na 205 ispitanika korištena je Raschova analiza za dobivanje daljnje valjanosti mjere, a diskriminacija stavki izračunata je putem point-biserijalnog koeficijenta korelacije. Rezultati pokazuju da TEL4 u svojoj prilagođenoj verziji, ima zadovoljavajuću valjanost za procjenu ekonomske pismenosti u Hrvatskoj. Trenutačno je u tijeku opsežno istraživanje ekonomske pismenosti na reprezentativnom uzorku u Hrvatskoj, uz korištenje ove prilagođene verzije TEL4 testa. To će doprinijeti daljnjoj potvrdi valjanosti prilagođenog instrumenta. Praktične implikacije takvog validiranog instrumenta mogu pridonijeti donošenju politika temeljenih na dokazima u vezi s ekonomskim obrazovanjem i razvojem kurikulumu u Hrvatskoj. Ograničenja istraživanja proizlaze iz dizajna studije poprečnog presjeka koji ne omogućuje praćenje promjena kroz vrijeme i prigodnog uzorka korištenog u pilot istraživanju koji ograničava mogućnost generalizacije rezultata. Rad doprinosi znanstvenoj literaturi o ekonomskoj pismenosti kao važnom aspektu suvremene ekonomije te

*predstavlja prvo istraživanje koje sustavno prilagodava i validira TEL4 test za hrvatski kontekst, slijedeći međunarodne standarde prevođenja i prilagodbe te koristeći Raschovu analizu. Stoga ovaj članak znanstveno doprinosi području metodološkog istraživanja prilagodbe instrumenata za ispitivanje ekonomske pismenosti izvan izvornog područja nastanka koncepta.*

**Ključne riječi:** Ekonomska pismenost, Test ekonomske pismenosti (TEL4), Prilagodba ispitnih instrumenata, Rasch analiza