Analyzing Models of Career Decision Self-Efficacy: First-order, Hierarchical, and Bifactor Models of the Career Decision Self-Efficacy Scale

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ABSTRACT

The goal of the study was to examine the dimensionality of the Career Decision Self-Efficacy Scale Short Form (CDSES-SF, Betz, Klein, & Taylor, 1996). Integrating several previous findings from different cultures, we found that the bifactor structure of the CDSES-SF on a Hungarian sample of 649 respondents showed the best model fit. This structure includes a general CDSE factor covering 15 items and the original five specific factors (self-appraisal, occupational information, goal selection, planning, and problem solving) covering three items each. This short form of CDSES shows an acceptable model fit and appropriate reliability in terms of the Cronbach alpha and omega values. Regarding career decision self-efficacy, a large proportion of variance was explained by the general factor and to a smaller extent by the specific factors. These results can be considered as a first step in resolving the paradox of the dimensionality of CDSES-SF.

Keywords: career decision self-efficacy, CFA, bifactor, factor analysis, reliability

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Career decision self-efficacy (CDSE) refers to one's beliefs about his/her ability to make career related decisions and complete career related tasks (Lent, Brown, and Hackett 1994). High CDSE has a positive influence on one's career-related behavior in terms of self-appraisal, planning, goal selection, gathering occupational information, and career-related problem solving (Crites 1978 as cited by Betz and Taylor 2012). Taylor and Betz's (1983) Career Decision Self-Efficacy Scale (CDSES) is the most widely used instrument, which has been validated in several countries. The goal of the present study is to examine the factor structure of the CDSES for better understanding its dimensionality and to resolve the paradox of the uni- vs. multi-dimensionality of this measurement.

Taylor and Betz (1983) created the original CDSES, a 50-item scale based on five competency areas. *The self-appraisal factor* refers to the extent one accurately assesses her/his career-relevant abilities, values, and interests. *Occupational information* refers to the extent of knowledge one has about university programs, occupations, and labor markets. *Goal selection* refers to the extent one can set priorities in order to manage successfully her/his professional advancement. *Planning* refers to the extent one can establish plans for the future and can identify career paths. Finally, *problem solving* refers to the extent one is able to figure out alternative coping strategies and solve career choice problems when outcomes do not go as intended; and that alternative leads to an integrative, socially acceptable, and personally satisfying solution (Betz and Luzzo 1996).

Subsequently, Betz, Klein, and Taylor (1996) shortened the CDSES to 25 items (CDSES-SF), including five items per factor. Although these five subscales appear to be important dimensions of career decision self-efficacy and have been investigated in several countries (see Table 1), the five-factor solution has not been definitely confirmed.

The Dimensionality of the CDSES-SF

Studies mentioned in Table 1 aimed to assess the factor structure of CDSES-SF with various methods (e.g. exploratory factor analysis, confirmatory factor analysis, or Rasch model approach). These studies reveal a paradox, because some of them support the notion that there is a single general career decision self-efficacy factor: using a Chinese sample, Jin, Ye, and Watkins (2012) chose the one-factor solution as final, because both in the first-order and second-order models, multicollinearity was present (due to high inter-factor correlations) and reliability values were rather low as opposed to the one-factor solution. Similarly, Miguel, Silva, and Prieto (2013) came to the same conclusion in Portugal. Beyond this general factor, no specific constructs were established in either case. Several authors (Creed, Patton, and Watson 2002; Jin et al. 2012; Nam, Yang, Lee, Lee, and Seol 2010) concluded that the use of a single, career decision self-efficacy factor would be more adequate than the multi-factor solution.

Regarding these multi-factor solutions, there has been support for the existence of two-factors by an American sample, namely information gathering and decision making (Peterson and del Mas 1998). Three-factor solutions have also been confirmed: Creed et al. (2002) identified information gathering, decision making, and problem solving in Australian and South African by using exploratory factor analysis (EFA). Complementing this procedure with confirmatory factor analysis (CFA), Hampton (2005) also established these three dimensions on a Chinese sample. Regarding four factors solutions, Chaney, Hammond, Betz, and Multon (2007) suggested a solution that was factorially complex and difficult to interpret as multiple items loaded on multiple factors. In France, Gaudron (2011) identified goal selection, problem solving, information gathering, and goal pursuit management factors with acceptable CFA indices and reliability. In Turkey, Buyukgoze-Kavas (2014) examined the original structure of Betz et al. (1996) which demonstrated less than ideal CFA indices and reliabilities. Moreover, the solution of Gaudron (2011) proved to be adequate in terms of factor structure, but not reliability as two factors were far below the acceptable value. Finally, the original five-factor structure was replicated in American (Miller, Roy, Brown, Thomas, and McDaniel 2009), Australian (Makransky, Rogers, and Creed 2014), and Italian (Presti et al. 2013) samples as well. In multiple cases, the number of items per factor also varied from study to study, making it difficult to comprehend the dimensions of career decision self-efficacy. In sum, it can be established that the dimensionality of CDSES has not been definitely confirmed and changing the number of items appears to be an adequate method.

Table 1. *Validity and reliability characteristics of the CDSES-SF in different nations*

Nation	*Sample*	*Total explained variance*	*EFA and reliability characteristics of the scale*	*Self-Appraisal*	*Occupational Information*	*Goal Selection*	*Planning*	*Problem Solving*	*Total Cronbach alpha*	*χ^2/df*	*RMSEA*	*CFI*	*Authors*
USA (original)	N_{EFA} = 184 N_{CFA} = — Age = — N_{items} = 25	62%	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	5 — — .73	5 — — .78	5 — — .83	5 — — .81	5 — — .75	.94	—	—	—	Betz et al. (1996)
South Africa	N_{EFA} = — N_{CFA} = 364 Age = 18.1 N_{items} = 25	—	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	5 — — .64	5 — — .74	5 — — .75	5 — — .73	5 — — .73	.91	3.05	.075	.83	Watson et al. (2001)
South Africa	N_{EFA} = 416 N_{CFA} = — Age = 15.30 N_{items} = 23	53.84%	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	11 .52 37.46% —		4 .58 6.62% —		8 .51 5.47% —	.93	—	—	—	Creed et al. (2002)[a]
Australia	N_{EFA} = 563 N_{CFA} = — Age = 15.45 N_{items} = 23	54.87%	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	11 .54 40.03% —		8 .52 5.67% —		4 .53 5.12% —	.94	—	—	—	Creed et al. (2002)[a]
China	N_{EFA} = — N_{CFA} = 256 Age = 21 N_{items} = 13	—	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	6 .60 — .77		4 .65 — .74		3 .66 — .69	.85	2.17	.06	.92	Hampton (2005)[b]
China	N_{EFA} = — N_{CFA} = 157 Age = 21 N_{items} = 13	—	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	6 .57 — .74		4 .63 — .71		3 .53 — .55	.82	1.94	.07	.90	Hampton (2005)[b]
China	N_{EFA} = 183 N_{CFA} = — Age = 17 N_{items} = 25	61.29%	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	5 — — .80	5 — — .80	5 — — .79	5 — — .74	5 — — .68	.93	—	—	—	Hampton (2006)[c]
USA (Afriacan Americans)	N_{EFA} = 220 N_{CFA} = — Age = 21.3 N_{items} = 25	62%	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	10 .62 21% .91	7 .59 16% .88	6 .61 15% .86		2 .77 10% .72	—	—	—	—	Chaney et al. (2007)[d]
USA (Asian Americans)	N_{EFA} = — N_{CFA} = 267 Age = 21.23 N_{items} = 25	43%	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	5 .59 3% —	5 .62 40% —	5 .72 52% —	5 .68 47% —	5 .59 37% —	—	1.93	.059	.97	Miller et al. (2009)[e]
USA	N_{EFA} = —	43%	*N of items:*	5	5	5	5	5	—	2.24	.072	.96	Miller et al. (2009)[e]

(European Americans)	N_{CFA} = 239 Age = — N_{items} = 25		*Average loading of items:* *Explained variance:* *Cronbach's alpha:*	.67 46% —	.63 40% —	.69 49% —	.63 41% —	.62 39% —					
France	N_{EFA} = 650 N_{CFA} = 650 Age = 21.4 N_{items} = 18	50.1%	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	5 .63 26.3% .69	3 .73 8.9% .73	5 .63 8.4% .67	5 .61 6.5% .69		.87	2.8	.054	.91	Gaudron (2011)[f]
China	N_{EFA} = — N_{CFA} = 796 Age = 24.85 N_{items} = 23	—	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*			23 .56 — .91			.91	4.99	.071	.85	Jin et al. (2012)[g]
Italy	N_{EFA} = — N_{CFA} = 2190 Age = — N_{items} = 25	—	*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	5 .62 38.7% .67	5 .56 32.02% .58	5 .61 39.52% .64	5 .62 38.12% .69	5 .50 37.75% .64	.89	5.21	.044	.97	Presti et al. (2013)[h]
Turkey	N_{EFA} = — N_{CFA} = 695 Age = 21.39 N_{items} = 18		*N of items:* *Average loading of items:* *Explained variance:* *Cronbach's alpha:*	5 .63 — .77	3 .73 — .64	5 .63 — .67	5 .61 — .75		.88	2.6	.048	.94	Buyukgoze-Kavas (2014)[i]

Notes. N_{EFA}= sample size of exploratory factor analysis (EFA); N_{CFA} = sample size of confirmatory factor analysis (CFA); Age = average age, if EFA and CFA were carried out in different samples, the sample size weighted age averages; N_{items} = number of items of the final inventory; Total explained variance = the sum of each factors' explained variance; N of items = number of items of the given factor; Average loading of items = the means of factor loadings of the items that belong to the given factor; Explained variance = the variance that the given factor explains in the factor structure; Cronbach's alpha = reliability coefficient which measure the internal consistency of the items that belongs to the given factor; χ^2/df = chi-square degree of freedom ratio; RMSEA = root mean square error of approximation; CFI = comparative fit index.. Although the results of Nam et al. (2011), Miguel et al. (2013), and Makransky et al. (2014) all indicate that the CDSES-SF has good reliability and validity, there results would be difficult to insert into Table 1 because of the different nature of the Rasch Model Approach.

[a] Creed et al. (2002) found four factors with items drawn from all the original five subscales in both the South African and the Australian samples, however, they only identified the first three factors (information gathering, decision-making and problem solving).

[b] Similarly to Creed et al. (2002), Hampton (2005) identified three factors with mixed items as well: information gathering, decision-making and problem solving.

[c] Although Hampton (2006) demonstrated a four-factor and a five-factor result as well, these solutions were complex and hard to interpret as multiple items loaded on multiple factors.

[d] Chaney et al. (2007) suggested a four-factor solution instead of the five-factor version, but both versions were factorially complex.

[e] Miller et al.'s (2009) comprehensive analysis demonstrated that the one-factor, the three-factor, and the five-factor solutions could be adequate. For this reason, they chose the theory-based five-factor solution.

[f] Gaudron (2011) proposed a 18-item version with four factors: goal selection (5 items), problem solving (3 items), information gathering (5 items), and goal pursuit management (5 items).

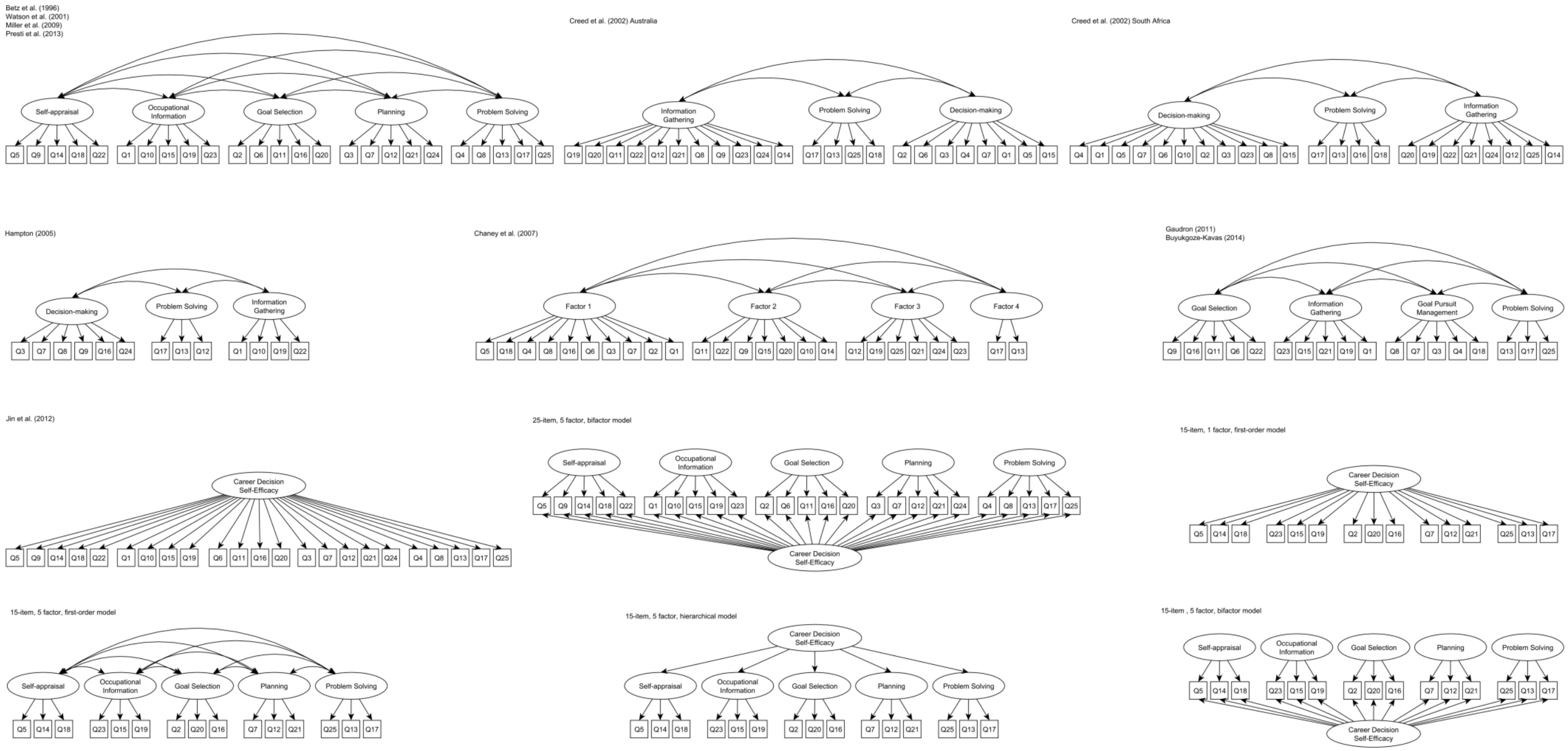
[g] Jin et al.'s (2012) final suggestion was a 23-item version with one general factor, career decision self-efficacy.

[h] According to Presti et al. (2013), both the one-factor and the five-factor solutions are plausible, however, the latter indicated slightly better fit.

[i] Buyukgoze-Kavas (2014) analyzed many previously published factor structures and the best fit indices resulted from the use of Gaudron's (2011) 18-item, 4 factor scale.

On the basis of these results, although the CDSES-SF is a reliable measure, its final factor structure has not been established yet. In the present study, we intend to resolve the paradox of one- vs. multifactor structures by using a bifactorial (or nested) model. These models can be applied when one general factor (in the present case career decision self-efficacy) and multiple specific factors (in the present case self-appraisal, occupational information, goal selection, planning, and problem solving) can be supposed to account for the commonality of the items (Brunner, Nagy, and Wilhelm 2012; Chen, Hayes, Carver, Laurenceau, and Zhang 2012; Chen, West, and Souza 2006). Bifactor models have several advantages over other structural solutions (Chen et al. 2006; Reise, Morizot, and Hays 2007): first, as the general and specific factor are orthogonal (i.e., uncorrelated); the domain-specific factors can be assessed simultaneously and independently of the general factor. Second, this model allows the examination of the relationship of both the indicators with the general factor and the indicators with the specific factors. By allowing the indicators to load on both general and specific factors, their plausibility and applicability can be assessed (Reise et al. 2007). Moreover, these simultaneous loadings on the general and specific factor can be seen as a more realistic representation of the psychological construct (Reise, Moore, and Haviland 2010). This model can be adequate regarding the CDSES because one of the most promising former studies found in two samples that both the five-factor structures and the one factor structure were similarly adequate (Miller et al., 2009). Therefore, under the umbrella of a general career decision self-efficacy factor, we can equally identify the five sub-dimensions instead of deciding between the unified, one-factor solution and the five-factor one. We assume that it is unnecessary to oppose the two solutions, but it is possible merge them. Furthermore, the suggested bifactor model can identify the complex relationship pattern of the sub-dimensions and the general factor. In sum, we suppose that a greater conceptual clarity can be reached by employing a bifactor model and comparing it to previous solutions.

Figure 1. *Alternative factor structures and the proposed model of the Career Decision Self-Efficacy Scale Short Form*



Notes. Q1-Q25 represent items of CDSES-SF.

Therefore, the primary goal of the present study was to twofold: first, we wanted to test all previously detailed models on a Hungarian high school sample (see Figure 1). Second, based on the previous results, we wanted to test a bifactor model which allows the general and specific factors as well, thus it might be an adequate procedure to address the question and the paradox of dimensionality regarding the CDSES-SF.

Methods

Participants and Procedure

A total number of 649 Hungarian high school students (female = 365; 56.2%), who were aged between 15 and 19 (M_{age} = 17.24, SD_{age} = 1.07), participated in this online questionnaire study. 17 of them (2.6%) live in the capital, 72 (11.1%) in county towns, 286 (44.1%) in towns, and 274 (42.2%) in villages. Participants were recruited from grammar schools (23.1%) and vocational schools (76.9%). Participants were informed about the goal and the details of the measurements. They were informed that by completing the questionnaire, they consented to the use of their answers in our research. Voluntary response was emphasized in the instructions, and anonymity was assured. Immediately after reading the informed consent, they agreed with the conditions of the research if they were willing to participate. If they did not agree with the terms and the informed consent, then the filling out did not start and they did not participate in the research any further. They filled out the questionnaire during class, and they were encouraged to give remarks and raise questions. Data collection was conducted in accordance with the Helsinki Declaration and was approved by the local ethical review committee. Besides the above mentioned protocol, the schools and parents (passive consent) were informed about the topic of the research.

Measures

The Career Decision Self-Efficacy Scale Short Form (CDSES-SF; Betz et al. 1996) is a 25-item scale assessing the individuals' career decision self-efficacy based on five dimensions (self-appraisal, occupational information, goal selection, planning and problem solving) that were detailed in the Introduction of the study. Respondents were asked to use a 5-point scale when answering (1 = No confidence at all; 5 = Complete confidence). The questionnaire was translated following the protocol of Beaton, Bombardier, Guillemin, and Ferraz (2000). First, two independent translations (by a psychologist and a career consultant expert) were created from English to Hungarian. These two versions then were synthesized and the discrepancies were discussed, resulting in a newer version with the approval of both translators. This newer version was then back-translated to English with two native speakers of the language. If there were any further discrepancies, they were discussed in details. The back-translated version was compared to the original one. After agreeing on the final translation, the questionnaire was sent out to a small number of students for pretesting. Based on their feedback, the wording of the questionnaire was adjusted, resulting in the final version.

Statistical analysis

A series of confirmatory factor analyses was conducted using Mplus 7.3 with robust maximum-likelihood (MLR) estimation (Muthén and Muthén 1998-2012). Multiple goodness-of-fit indices were considered when assessing the model (Brown 2015; Kline, 2011; Schreiber, Stage, King, Nora, and Barlow 2006) as a more thorough examination of fit indices can provide different information for evaluation a model. For instance, the following indices were used: Comparative Fit Index (CFI), the root mean square error of approximation (RMSEA), its 90% confidence interval (90% CI), the test of close fit (CFit), and the standardized root mean square residual (SRMR). Additionally, the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were observed in order to compare the different models. Values were good if they met the following criteria (Hu and Bentler 1999; Kline 2011): CFI (≥ .95), RMSEA (≤ .06), CFit (≥ .05, *ns*), and SRMR (≤ .08). The AIC and the BIC do not have a clear cut-off point. The lower the value, the better the model fit is. Finally, the Satorra-Bentler scaled χ^2 was applied to determine which of the alternative models is the better fitting one (Satorra & Bentler, 1994).

Reliability in terms of internal consistency was measured by Cronbach's alpha and Nunnally's (1978) suggestions were followed regarding the adequacy of the value (.70 is acceptable, .80 is good). However, we also took into consideration that internal consistency and Cronbach's α values can be lower if the number of items of a given scale is lower (Cortina 1993). We followed the guidelines of several methodologists (Brunner et al. 2012; Rodriguez, Reise, and Haviland 2015) for assessing reliability in nested models, omega values were assessed which can more precisely grasp the reliability of bifactor models. The value of omega (ω) informs on the measurement precision *"with which a scale score assesses the blend of the general/higher order and specific constructs"*. The omega hierarchical (ωh) indicates "*how precisely a total score assesses a general construct as specified in a higher order or a nested-factor model*". The higher the omega coefficients are, the more the group of items is related to the given latent variable. The omega and the omega hierarchical values can range from 0 (no reliability) to 1 (perfect reliability). Beyond this, there is no such minimum value for acceptable reliability as in the case of Cronbach's α.

Results

Investigation of the factor structure

A series of confirmatory factor analyses was conducted on the CDSES-SF items in order to test alternative models. All the previous models highlighted in Table 1 were examined. As it can be seen in Table 2, neither the models with the original item set, nor the previously reported models showed adequate fit. In several cases, modification indices revealed several error covariances and significant cross-loadings. As a result, the residual covariance matrix was not positive definite (due to high correlations between the factors), indicating multiple problems with the models. However, instead of improving our model by arbitrarily and extensively using error covariances, we chose to reduce the number of items per factor. After identifying that the 25-item five-factor bifactor model had acceptable model fit—even if model fit indices as CFI = .903, CFit = .003, and SRMR = .045 were far from perfect—similarly to Buyukgoze-Kavas (2014), Creed et al. (2002), Gaudron (2011), Hampton (2005), and Jin et al. (2012), we aimed to keep the most appropriate items. Creed et al. (2002) also stated that the number of the items could be reduced. However, instead of random selection of the items, we took into consideration and eliminated items based on four principles: (1) small factor loadings (< .45), (2) high cross loadings (> .30), by (3) following modification indices suggestions, and by (4) considering the standardized residual covariances (Brown 2015; Byrne 2010). We aimed to create a model with good fit indices and no misspecifications by preserving at least three items per factor.

Table 2. *Comparison of the alternative models of the Career Decision Self-Efficacy Short-Form*

	Model	CFI	RMSEA [90% CI]	CFit	SRMR	AIC	BIC	Satorra- Bentler Scaled Chi^2	df	*p* (<)
Models with the original item set	**25-item, 1 factor, first-order model (baseline)**	.886	.059 [.055-.064]	.000	.049	36987	37323	698,86	200	.001
	25-item, 5 factor, first-order model (original)							654,84	190	.001
	Betz et al. (1996); Watson et al. (2001); Miller et al. (2009); Presti et al. (2013)	.893	.059 [.054-.063]	.000	.048	36934	37314	585,78	175	.001
	25-item, 5 factor, bifactor model	.903	.058 [.053-.062]	.003	.045	36821	37269	464,46	152	.001
Previously tested models with various set of items	**23-item, 3 factor, first-order model**							475,75	152	.001
	Creed et al. (2002) – South African sample	.909	.055 [.050-.060]	.047	.046	34106	34428	549,84	194	.001
	Creed et al. (2002) – Australian sample	.910	.056 [.051-.060]	.028	.047	33676	33998	203,96	54	.001
	13-item, 3 factor, first-order model							544,04	155	.001
	Hampton (2005)	.908	.070 [.061-.079]	.000	.050	20707	20895	69,81	15	.001
	25-item, 4 factor, first-order model							27,39	5	.001
	Chaney et al. (2007)	.912	.053 [.048-.057]	.143	.045	36778	37141	29,30	10	.001
	18-item, 4 factor, first-order model							698,86	200	.001
	Gaudron (2011); Buyukgoze-Kavas (2014)	.925	.058 [.051-.064]	.025	.043	26919	27187	654,84	190	.001
	23-item, 1 factor, first-order model							585,78	175	.001
	Jin et al. (2012)	.894	.059 [.054-.064]	.001	.048	34158	34467	464,46	152	.001
New item set selected on the basis of four criteria[a]	**15-item, 1 factor, first-order model**	.933	.057 [.049-.064]	.071	.040	22389	22590	475,75	152	.001
	15-item, 5 factor, first-order model	.947	.054 [.046-.062]	.221	.035	22324	22570	549,84	194	.001
	15-item, 5 factor, hierarchical model	.946	.052 [.044-.060]	.304	.036	22329	22553	203,96	54	.001
	15-item, 5 factor, bifactor model	.953	.052 [.044-.061]	.333	.034	22308	22576	This model was used as comparison.		

Notes. CFI = comparative fit index; RMSEA = root-mean-square error of approximation; CFit = RMSEA's test of close fit; SRMR = standardized root mean square residuals; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; [a]Items were eliminated based on their (1) small factor loadings (< .45), (2) high cross loadings (> .30), by (3) following modification indices suggestions, and by (4) considering the standardized residual covariances (Brown 2015; Byrne 2010); df = degree of freedom. 13-item, 3 factor-first-order model cannot be computed because in this case, the chi square value was higher and the df was lower than in the 15-item, 5 factor, bifactor model. However, on the basis of the other model comparison methods, it seems to be clear that the 15-item, 5 factor, bifactor model is better than the 13-item, 3 factor-first-order model.

Several solutions were tested with the 15 items. Although the models—the one factor first-order, the five factor first-order and the five factor hierarchical models—had acceptable fit, the same model misspecification was indicated as in the previous cases. Despite these deficiencies, compared to the majority of previous models, the 15-item solutions appeared to be adequate on the basis of CFit, AIC and BIC indices. Among these solutions, the 15-item bifactor version had the best model fit considering all indices (CFI = .953, RMSEA = .052, 90% CI .044-.061, CFit = .333, SRMR = .034) without any model misspecification[1]. The bifactor model also has acceptable reliability in terms of Cronbach alpha values. Based on model comparison indices (ΔCFI, ΔRMSEA, AIC, BIC), this model appears to be saliently the best among the other alternatives. Even though the factors of the bifactor model were not allowed to covariate, their means show high correlation with each other (for descriptive data see Table 3). The final factor structure can be seen in Figure 2.

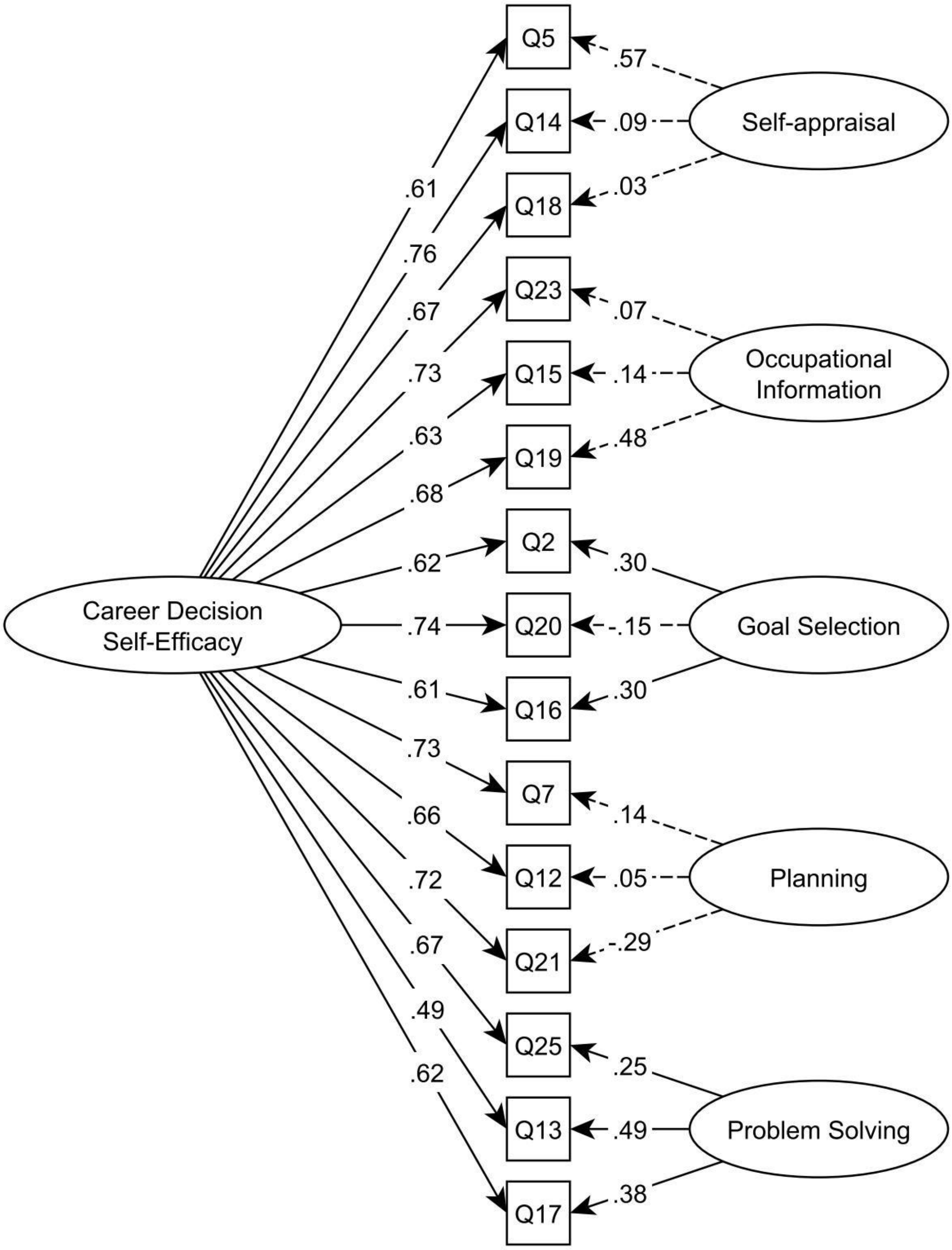
Table 3. *Descriptive statistics and correlation between the CDSES-SF factors*

Scales	α	ω	ω_h	Range	Mean	SD	1	2	3	4
1. self-appraisal	.74	.78	.08	1-5	3.69	.72	—			
2. problem solving	.74	.75	.22	1-5	3.56	.76	.64**	—		
3. planning	.73	.76	.00	1-5	3.76	.77	.73**	.65**	—	
4. occupational information	.75	.77	.08	1-5	3.87	.78	.69**	.59**	.74**	—
5. goal selection	.69	.73	.04	1-5	3.74	.76	.74**	.58**	.71**	.67**

Notes. α = Cronbach alpha value; ω = omega, ω_h = omega hierarchical; ***p* < .01

[1] After identifying the full bifactor model, upon the request of the reviewers, we tested a partial bifactor model in which only the significant loadings of two specific factors (problem solving and goal selection) were retained. However, the first-order derivative product matrix was not positive definite, indicating multiple problems with this solution. Therefore, we retained the full bifactor model.

Figure 2. *The factor structure of the Bifactor Career Decision Self-Efficacy Scale 15 item version*



Notes. Dashed arrows indicate non-significant links. Factor loadings are standardized.

Reliability of the scales

Each factor of CDSES-SF demonstrated acceptable or good levels of reliability (see Table 3). All of the Cronbach's α values were above .69. Omega values showed high levels of reliability. They ranged between .73 and .78. The omega hierarchical values were small, ranging between .00 and .22, indicating a relatively low level of reliability in the case of specific factors. The omega hierarchical of the problem-solving factor appeared to be the strongest among the other factors. However, if we take into account the classic internal consistency α values, the reliability of the five factors internal consistency was appropriate.

Discussion

The goal of the present study was to resolve the paradox of the factor structure of the CDSES-SF. By implementing a bifactor structure including a general factor and five specific factors, the multifaceted construct of career decision self-efficacy can be a realistic representation of this psychological construct (Reise et al. 2010). Compared to the other solutions, the bifactorial one showed good factor structure. In terms of internal consistency, all factors had acceptable reliabilities. In terms of omega and omega hierarchical values, results suggest that the general factor explained the largest proportion of the variance, except for the problem solving factor.

One of the advantages of the bifactor models is that it helps to identify a broad and unique factor in addition to the domain-specific factors (Patrick, Hicks, Nichol, and Krueger 2007). Previous international studies found that CDSES-SF has a one-factor structure (Jin et al. 2012; Miguel et al. 2013); whereas, others found that it has a multifactor structure (Betz et al. 1996; Buyukgoze-Kavas 2014; Chaney et al. 2007; Creed et al. 2002; Gaudron 2011; Hampton 2005). The original five-factor structure was also replicated before (Makransky et al. 2014; Miller et al. 2009; Presti et al. 2013). In the present study, using a Hungarian high school sample, we were not able to successfully replicate the original factor structure. Moreover, several model misspecification errors appeared when these models were examined. The bifactor model was successful in solving the problems arising from the high inter-factor correlations by not allowing them to correlate at all (Chen et al. 2006; Reise et al. 2007). It is possible that in these countries where the successful replication occurred, the dimensions of the CDSE are more separated. However, in other cultures—despite their importance—their separateness might not be very prominent. The results of the present study can be considered as the first steps in solving the paradox of the dimensionality of the CDSES-SF. The next step might be the testing of this model in many different cultures and educational contexts.

In the case of the Hungarian results, a large proportion of variance of career decision self-efficacy was explained by the general factor. The results showed that the variance of self-appraisal, occupational information, planning, and goal selection were mainly explained by the general career self-efficacy factor. In these cases, the common variance of the items was entirely explained by the general factor, indicating that the specific factors did not exist over and above the general factor, thus cannot be considered as unique contributors. Therefore, in the case of bifactor models, it is natural that either general or specific factor loadings become non-significant. In the present case, it can be concluded that the plausibility of these four factors was diminished as the general factor explained a large proportion of variance (Reise et al. 2007).

The explained variance of problem solving—compared to the other four factors—is somewhat more attributable to the specific component of career self-efficacy. This dimension appears to be a separate construct. One can suppose that self-appraisal, occupational information, planning, and goal selection may belong to the first phase of the career decision in terms of preparing for a certain potential career pathway. However, career related problem solving might belong to a second phase, since changing career choices often appears as a consequence of previous career related decision attempts which did not lead to satisfactory outcomes. Therefore, we assume that while the first phase is required for planning including gathering information about the individual's resources and the potential paths, selecting goals and planning potential steps belong to the first phase in which the "trial and error" steps mainly happen in the head of the individual. However, the problem-solving phase necessarily appears when the individual has already started to do concrete things in order to achieve the chosen career path.

The present version of CDSES has some merits and some weaknesses. Among the strengths are that it is short, it has good structural validity, it is reliable, and it is the first measure in Hungary which grasps any forms of the self-efficacy in an occupational context. Furthermore, compared to all alternative models both theoretically and methodologically, the 15-item bifactor model appeared to be the most adequate. Among the weaknesses are the lack of test-retest measures, and the lack of convergent, divergent, and predictive validity. Furthermore, the study would be valuable if it included more diverse populations (i.e. adults or workers). Replicating the analysis—with the same bifactor structure and the same set of items for each factor—in the US and in other cultures with different educational contexts might be a beneficial future direction of the research on CDSES-SF. Finally, it would be fruitful to use this measure in future randomized control trial interventions in which students' career decision self-efficacy is the focus of development.

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