

Analysis of the professional choice self-efficacy scale using the Rasch-Andrich rating scale model

Rodolfo A. M. Ambiel¹ · Ana Paula Porto Noronha¹ · Lucas de Francisco Carvalho¹

Received: 18 March 2014 / Accepted: 30 March 2015 / Published online: 8 April 2015
© Springer Science+Business Media Dordrecht 2015

Abstract The aim of this research was to analyze the psychometrics properties of the professional choice self-efficacy scale (PCSES), using the Rasch-Andrich rating scale model. The PCSES assesses four factors: self-appraisal, gathering occupational information, practical professional information search and future planning. Participants were 883 Brazilian high school students. The results showed the unidimensionality of each of the four factors. Items tended to be easily endorsed by the sample, and the data were well adjusted to the model. A clear representation of each of the four response categories was observed. Practical implications are discussed.

Résumé. Analyse de l'échelle du sentiment d'efficacité personnelle dans le choix professionnel à l'aide du modèle d'échelle de mesure de Rasch-Andrich. L'objectif de cette recherche était d'analyser les qualités psychométriques de l'échelle du sentiment d'efficacité personnelle dans le choix professionnel (PCSES) en utilisant le modèle d'échelle de mesure de Rasch-Andrich. Le PCSES mesure quatre facteurs: l'auto-évaluation, la réunion d'information sur les professions, la recherche d'informations concrètes sur le monde professionnel et la planification du futur. Les participants se composaient de 883 étudiants de lycées brésiliens. Les résultats montrent l'unicité de chacun des quatre facteurs. Les items ont été facilement choisis par l'échantillon et les données étaient bien ajustées au modèle. Une représentation claire de chacune des quatre catégories de réponses a été observée. Les implications pratiques sont discutées.

✉ Rodolfo A. M. Ambiel
rodolfo.ambiel@usf.edu.br

¹ Postgraduate Program for Studies in Psychology, Universidade São Francisco, Rua Alexandre Rodrigues Barbosa, 45, Centro, Itatiba, SP 13251-900, Brazil

Zusammenfassung. Eine Analyse der Skala zur Selbstwirksamkeit zur Berufswahl mit dem Rasch-Andrich Modell. Das Ziel dieser Untersuchung war es, die psychometrischen Eigenschaften der Skala zur Selbstwirksamkeit zur Berufswahl (PCSES) mit dem Rasch-Andrich Verfahren zu analysieren. Die PCSES erfasst vier Faktoren: Selbsteinschätzung, das Sammeln von Berufsinformationen, praktische Berufsinformationssuche und Zukunftsplanung. Die Teilnehmer der Studie waren 883 brasilianische Schüler. Die Ergebnisse zeigten eine Eindimensionalität von jedem der vier Faktoren. Die Items wurden durch die Stichprobe bestätigt und die Daten passten gut zum theoretischen Modell. Jede der vier Antwortkategorien war eindeutig repräsentiert. Praktische Implikationen werden diskutiert.

Resumen. Análisis de la Escala de Autoeficacia de la Elección Profesional usando el modelo de escala de valoración Rasch-Andrich. Esta investigación analizó las propiedades psicométricas de la Escala de Autoeficacia en la Elección Profesional (EAEP/PCSES), usando el modelo de escala de valoración Rasch-Andrich. La (EAEP/PCSES) evalúa cuatro factores: autovaloración, recogida de información ocupacional, búsqueda de información profesional práctica y planificación futura. Participaron 883 estudiantes de Educación Secundaria de Brasil. Los resultados mostraron la unidimensionalidad de cada uno de los cuatro factores. Los items fueron respaldados fácilmente por la muestra; los datos se ajustaron bien al modelo y se observó una clara representación de cada una de las cuatro categorías de respuestas. Se discuten las implicaciones prácticas del estudio.

Keywords Career self-efficacy · Rasch model · Psychometrics

According to Lent, Brown and Hackett (1994), occupational choices are complex challenges faced by people in various moments of life, beginning at the end of adolescence. Occupational choice is an important step in the career development process, taking place after interest formation and before effective entrance into college or the job force. Lent et al. (1994) claimed that, although interests tend to become defined and crystallize during adolescence, career choices can be made throughout the life span, resulting in the development of skills, beliefs, and expectations related to interests and abilities and the capacity to make appropriate decisions.

The social cognitive career theory (SCCT; Lent et al., 1994), considers the concept of self-efficacy (cf. Bandura, 1977) important because its role as a mediator of both development of occupational interests and actions of engagement in the career decision process. According to Bandura (1977), self-efficacy is a personal, domain-specific variable that can be defined as one's beliefs in his or her ability to organize and execute courses of action required to produce certain outcomes; its assessment must take into account the level of challenge that the outcome represent to the person assessed. If one interprets an activity as easy or not challenging to

perform, then s/he probably will see himself or herself as skilled and efficacious in that domain (Bandura, 2006).

Hackett and Betz (1981) and Taylor and Betz (1983) introduced the concept of self-efficacy in the context of career development, presenting studies using the career decision self efficacy scale (CDSE), which was based both on Bandura's (1977) self-efficacy and Crites' (1961) career choice competencies, derived from his theory of career maturity (Crites, 1961, 1978). These competencies, which facilitate the process of choice, are called accurate self-appraisal, (ability to accurately appraise one's own abilities, interests, and values), gathering occupational information (ability to search for information about college majors and occupations in newspapers, magazines, internet, other medias and talking with people already studying or employed in majors or occupations of interest), goal selection (ability to suit one's own characteristics to the demands and rewards of majors and careers), problem solving (ability to figure out new plans or coping strategies when plans do not go as intended) and future planning (ability to implement an educational or career choice, such as educational programs and job search strategies; Betz & Taylor, 2012).

Several studies have been performed using full and shortened versions of the CDSE, with original or language-adapted items, in countries such as Australia (Creed, Patton, & Prideaux, 2006; Creed, Patton, & Watson, 2002), China (Jin, Ye, & Watkins, 2012; Wang, Zhang, & Shao, 2010), France (Gaudron, 2011), Italy (Di Fabio & Maree, 2012; Lo Presti et al., 2013), Portugal (Silva, Paixão, & Albuquerque, 2009), South Africa (Watson, Brand, Stead, & Ellis, 2001) and the USA (Andrews, Bullock-Yowell, Dahlen, & Nicholson, 2014; Metheny & McWhirter, 2013). Among the results of these studies, the relationship between career decision self-efficacy and professional interests indicates that people who are less consistent in their interests tend to have lower self-efficacy scores (Srsic & Walsh, 2001), as well as negative correlation with vocational indecision results were found (Creed et al., 2006).

Correlations between career decision self-efficacy and personality was also observed, with negative coefficients between career decision self-efficacy and neuroticism and positive coefficients between career decision self-efficacy and extraversion and conscientiousness (Page, Bruch, & Haase, 2008). Additionally, the self-efficacy evaluation appears to have diagnostic potential in the counseling process, differentiating clinical from control groups in experimental situations (Reese & Miller, 2006; Fouad, Cotter, & Kantamneni, 2009; Wang et al., 2010; Di Fabio & Maree, 2012; Talib, Salleh, Amat, Ghavifekr & Ariff, 2014).

However, the main problem faced in the assessment of career decision self-efficacy involves the empirical verification of the internal structure of the assessment instrument. As mentioned earlier, the construct has been evaluated based on Crites' five competencies to choose a career, but the results are conflicting. The methodologies used in the proposals and confirmation of the number and composition of factors is another issue to be considered (Taylor & Betz, Taylor and Betz 1983; Betz, Klein, & Taylor, 1996; Miller, Roy, Brown, Thomas, & McDaniel, 2009).

Among the notable results supporting the Crites's model, Ramirez and Canto (2007) found five factors similar to the theoretical model using exploratory factor

analysis in Mexico. Miller et al. (2009) used confirmatory factor analysis and supported the five factors in two independent US samples. However, in the same study, the authors reported alternative models composed of one and three factors. Other studies using confirmatory factor analysis did not support the proposed structure (e.g., Gaudron, 2011; Watson et al., 2001). Others' results suggested structures with two (Peterson & DelMas, 1998; Silva et al., 2009), three (Creed et al., 2002; Hampton, 2006) and four (Chaney, Hammond, Betz, & Multon, Chaney et al. 2007) factors.

Alternatively, researchers have tested CDSE-SF structures and the functioning of its items using the Rasch model. Nam, Yang, Lee, Lee, and Seol (2011) studied the Korean version of the instrument. The authors reported that it is possible to consider the scale as one set of items assessing a single trait, with the exception of three items. Moreover, only one item presented a misfit with the model, with infit and outfit indices (i.e., model fit indexes, consisting of average values of the residues) outside the expected range. The item map, a graphic plotting the sample (left) and items (right) according to the level in the latent construct, evidenced that the person average is above the items average, suggesting that the sample readily endorsed the items. Finally, the 5-point Likert-type scale was found to function adequately, with thresholds (i.e., the intersection between each category in a rating scale) increasing monotonically according to category levels.

Miguel, Silva, and Prieto (2013) analyzed the Portuguese version of the CDSE-SF in another study with a similar goal. The results showed that all items had good fit indices, with infit and outfit means of 1.0. The people measure mean (theta, the level of the person in the latent construct) was .71; thus, the items can be considered easily endorsed by the sample. The unidimensionality of the 25 items (i.e., the capacity to one-construct assessment priority) was supported by appropriate indices of item-theta correlation, which is similar to the item-total correlation, varying between .41 and .69, a reliability of .97 and data obtained from principal component analysis (PCA) of the standardized residuals. The authors also indicated that the 5-point category functions were adequate, fulfilling the literature criteria.

In Brazil, Ambiel and Noronha (2012) built the professional choice self-efficacy scale (PCSES), consisting of 47 items and a 4-point Likert-type scale, based on the CDSE literature. Although the PCSES is not a version of the CDSE, it is a different set of items written in Brazilian Portuguese intending to represent the Crites's (1961) five competencies. The problem with internal structure also was detected in the PCSES since its content validity analysis (Ambiel & Noronha, 2011). The four-factor structure was obtained by exploratory factor analysis of data from Brazilian high school students. Authors named the subscales self-appraisal, gathering occupational information, practical professional information search, and future planning.

Ambiel and Noronha (2012) considered the PCSES's structure partially related to the CDSE model. Self-appraisal and future planning subscales on the PCSES correspond to the similar ones on the CDSE, but gathering occupational information and practical professional information search evaluate different facets of the CDSE's gathering occupational information. The PCSES's gathering occupational information subscale assesses one's beliefs in his or her ability to gather information about majors and careers search information in a variety of media, such as books, newspapers, magazines, and internet sites. The practical professional information

search subscale involves an interpersonal ability to get information from talks with students and professionals, attending lectures with fellows and teachers, and from visiting universities and workplaces. Although goal selection and problem solving items were written and applied, they did not group on any factor.

Additionally, Ambiel and Noronha (2012) reported moderate, positive correlations of the PCSES subscales with extraversion, agreeableness, and conscientiousness, and negative correlations with decision making difficulties. Differences between gender and administrative type of school were also reported, with higher means for women and private school students when compared to men and public school students. Reliability ranged from .79 (future planning) to .88 (self-appraisal).

As described, the PCSES and the CDSE are different instruments but were constructed under the same theoretical model and intend to assess constructs with similar goals in a career counseling process, i.e., confidence in the abilities to make career or professional choices. Their current versions, including both complete and short forms of the CDSE, share some similarities and problems in factor structure and reliability indexes, although there are also significant differences.

Even using different techniques in several studies over three decades, there is still no empirical consensus on the dimensionality for assessing the construct of self-efficacy. Moreover, the majority of published articles on the subject have focused on the use of factor extraction techniques, ignoring other important data, such as the items' fit to scale and the endorsement probability of the items. Notably, most studies assessing the psychometric parameters of career decision self-efficacy instruments, including the PCSES, are based on classical test theory (CTT). However, it is increasingly common for researchers to use an alternative mathematical model to evaluate and guide scale development, such as item response theory (IRT; e.g., Walton, Roberts, Krueger, Blonigen, & Hicks, 2008), which emerged from criticism of CTT (Hambleton & Van der Liden, 1982; Wolfe & Smith Jr., 2007). For polytomous items (i.e., Likert-type scale), the Andrich rating scale model, a specific mathematical model based on the Rasch model, has been used to analyze data to test the validity and the reliability of instruments.

In this article, we analyze the PCSES psychometric properties using the Rasch-Andrich rating scale model, testing whether the instrument shows adequate psychometric properties from an IRT perspective. More specifically, we developed three hypothesis based on the literature, all of them directly or indirectly referring to the PCSES factors' interpretability. Our hypothesis are: (a) the four factors of the PCSES are unidimensional, but all of the sets of items are not; (b) the PCSES items tend to be easily endorsed (i.e., agreed upon) by respondents; and (c), four-point categories will adequately function on all factors.

Method

Participants

The participants were 883 high school students (51.6 % female) 14–21 years old ($M_{age} = 16.10$, $SD = 1.2$), from private (54.7 %) and public (45.3 %) schools in

four cities in two Brazilian states (São Paulo and Minas Gerais). In the Brazilian educational system, high school lasts three years and students are expected to be between 15 and 17 years old, but depending on birth month, this range can be between 14 and 18. However, there is a serious dropout problem in Brazil due to low academic performance, necessity to work, or both, that causes young adults to re-enroll in school. This explains the range of ages we observed in this sample. The students were enrolled in the first (31.8 %), second (36.8 %) and third years of high school (31.4 %).

Instrument

Professional choice self-efficacy scale (PCSES; Ambiel & Noronha, 2012). This 47-item, 4-point Likert-type scale measures high school students' confidence in engaging in occupational choice tasks. It evaluates the following four subscales: self-appraisal, or the degree to which one's beliefs describe one's own abilities and interests (17 items; example, "List which activities you most like to do"); gathering occupational information, or the efficacy with which one can obtain information about courses and careers from books, newspapers, magazines and the internet (11 items; example, "Use the internet to know more about a profession"); practical professional information search, or one's confidence in obtaining information about courses and careers by interpersonal means in face-to-face interviews and visits (11 items; example, "Visit the workplace of a professional you admire"); future planning, or one's personal sense of one's capacity to know about his/her career future, job availability and salary possibilities (8 items; example "Find out the salary of a professional of the area in which you are interested in working"). Validity was indicated by exploratory factorial analysis and by verifying relationships with personality, professional interests, and career decision making difficulties. Cronbach's alpha ranged from .79 (future planning) to .88 (self-appraisal).

Procedure

First, the authors contacted the schools' principals and asked to proceed with data collection. Once authorized, the research project was submitted and approved by the Ethics in Research Committee of São Francisco University. Then, students were invited to participate and received an informed consent form (IC), that was signed by the parents of students under 18 years old, and by themselves for students over 18 years old, in accordance with Brazilian law. All the participants were invited to enroll in a lecture about professional choice and career development, presented by the authors. The instruments were administered in paper-and-pencil format by the authors with help of three undergraduate students, in classrooms with up to 40 high school students each.

Data analysis procedure

The data were analyzed using the Rasch-Andrich rating scale model (Wright & Masters, 1982), an extended expression of the standard IRT, specifically, the Rasch

model. One of the basic postulates of IRT modeling is unidimensionality; the model assumes that items measure a primary dimension and secondary dimensions have a negligible influence (Hambleton & Swaminatham, 1985). So, our first hypothesis was verified using PCA of standardized residuals implemented through Winsteps, and the 2.0 Eigenvalue criteria (Linacre & Tennant, 2009), i.e., contrasts with Eigenvalue greater than 2 were considered as a second dimension.

The item and subject model parameters were calibrated by the joint maximum likelihood estimation method implemented in Winsteps software (Linacre, 2011). In this point the second hypothesis (i.e., the PCSES items tend to be easily agreed by respondents) was verified. The fit of this calibration was assessed by the fit indexes *infit* and *outfit*, which were calculated for all items and subjects. The values are directly proportional to the residuals reflecting the differences between the observed and expected responses as hypothesized from knowledge of the model parameters, with values greater than 1.3 indicating misfit (Wright & Linacre, 1994). In practical terms, these indexes reflect how much the items and the subjects behavior as the mathematical model predicts. If an item does not work as expected, more attention must be carried to it, and the research must considerate if the item should be dropped. If the misfit is observed in the sample, in much cases, so the research should investigate the quality of the application in the case or even the appropriateness of the items to this kind of sample. To enable calibration, the model requires that the theta mean or the difficulty (*b*) mean be fixed. We used the Winsteps default, i.e., the *b* mean was fixed to zero (representing an arbitrary and not an absolute zero).

The Rasch-Andrich rating scale model assumes that advances in the rating scales are constant and equal for all items (Embretson & Reise, 2000), a suitable attribute to instruments with Likert-type scales form of response. In this model, the probability of choosing a specific Likert category is given by

$$\Pr\{X_{ni} = 1\} = \frac{\exp \sum_{k=0}^x (\beta_n - (\delta_i - \tau_k))}{\sum_{x=0}^m \exp \sum_{k=0}^x (\beta_n - (\delta_i - \tau_k))}$$

where β_n is the level in the latent construct of person *n* and δ_i is the level in the latent construct (i.e., difficult) of item *i* and τ_k is the *k*th threshold of the rating scale in common. The parameter τ_k is the threshold between response points. A four-point Likert scale (e.g., 1, 2, 3 and 4) will have three thresholds representing the transition between points 1 and 2 (λ_1), 2 and 3 (λ_2) and 3 and 4 (λ_3). These points represent levels in the dimension that mark the transition of the probability of observing one point (e.g., 1) to that of the next higher point (e.g., 2). At the exact point corresponding to the threshold, the probability of choosing each of the two points is equal. Above the threshold, the higher score becomes more likely, and below it, the lower point becomes more likely. Therefore, the distance between the thresholds determines the intervals in the latent dimension associated with the probability of particular response points occurring. A distinctive feature of the rating scale model is that these scalar intervals between points are similar for all items. The categories response thresholds verification refers to the third hypothesis, that the likert categories will adequately function in all factors. The difficulty parameter b_i represents

Table 1 Variance explained and first contrasts in the four factors

	Explained variance		First contrasts	
	Eigenvalue	%	Eigenvalue	%
F1—self-appraisal	8.7	33.8	1.8	7.1
F2—gathering occupational information	6.3	36.5	1.6	9.3
F3—practical professional information search	6.3	36.4	1.6	9.3
F4—future planning	4.1	37.0	1.7	15.6

the location of item i or the average intensity of the thresholds of an item. Items that represent extremes in the latent dimension are represented with high average thresholds because their thresholds are all located on the most intense theta levels.

Results

First, the 47-item dimensionality of the PCSES was verified. The PCA of standardized residuals was used, and the obtained data demonstrated 18.1 % of the explained variance, with the Eigenvalue of first contrast having a magnitude greater than 2.0, indicating at least one relevant pool of items in addition to the main dimension (Linacre, 2011). In other words, the Eigenvalue greater 2.0 indicated that it is not possible to perform the analysis in the present sample with all item pool. Table 1 presents the explained variance by factor and the unexplained variance, as represented by the first contrast in all four factors.

As reported in Table 1, all factors showed explained variance above 30 %. Furthermore, suggesting the unidimensionality of each factor, none of the contrasts reached a value equal to or greater than 2. Linacre (2011) developed this criterion explaining that a pool of items should present an Eigenvalue of greater than 2 to be considered more than a unique item. On one hand, this result does not state the number of factors the PCSES should have; on the other hand, this result does corroborate that (a) the pool of items is not unidimensional and that (b) each PCSES factor is consistent enough to be considered as unidimensional, therefore supporting our first hypothesis. Table 2 summarizes the descriptive statistics of the thetas (level on the latent trait) and the respective fit indices (infit and outfit) for the PCSES factors.

The average level of the latent traits found suggest that, overall, the items tend to be easily endorsed for people in the sample. In other words, the sample tended to show a lower level in the latent construct (self-efficacy) compared to the construct level of the items. Factor 3 had the lowest mean theta (1.05) and Factor 4 the highest (1.58), corresponding to items that were the least and most endorsed (i.e., agreed) by the participants, respectively.

In Table 2, the model fit indices, the infit and outfit values, assess the correspondence between the observed and expected values of the theta estimates for respondents. The former is more sensitive to unexpected patterns of observations by

Table 2 Summarized descriptive statistics of the thetas

	Theta	SE	Infit	Outfit
Factor 1—self-appraisal				
Mean	1.30	.39	1.02	1.01
SD	1.03	.13	.53	.53
Maximum	4.16	1.02	3.47	3.69
Minimum	−1.94	.29	.05	.06
Factor 2—gathering occupational information				
Mean	1.10	.46	1.01	1.00
SD	1.01	.15	.51	.51
Maximum	3.48	1.02	3.23	3.45
Minimum	−2.29	.35	.06	.06
Factor 3—practical professional information search				
Mean	1.05	.46	1.02	1.00
SD	1.06	.15	.54	.54
Maximum	3.54	1.02	3.42	3.44
Minimum	−3.50	.35	.03	.03
Factor 4—future planning				
Mean	1.58	.65	1.00	1.00
SD	1.14	.16	.63	.62
Maximum	3.54	1.06	4.00	4.03
Minimum	−3.39	.49	.02	.02

people with theta values that are close to the item's difficulty level, and the latter is more sensitive to unexpected observations by people with theta values that are far from the item's difficulty level (e.g., when people with high levels in self-efficacy do not agree with construct low level items or people with low levels agreeing with construct high level items). These values were adequate (Wright & Linacre, 1994), as the average was below 1.20.

Furthermore, the reliabilities of the theta estimates calculated by the model were .84 (Factor 1), .77 (Factor 2), .79 (Factor 3), and .66 (Factor 4). These rates can be considered satisfactory, suggesting few errors in self-efficacy evaluation, even for Factor 4, based on the small number of items of this scale. The descriptive statistics for the items are summarized in Table 3.

Table 3 summarizes the descriptive statistics for the items. The difficulty indices for endorsing each item category varied between $-.70$ and $.45$, with standard deviations of approximately two logit (except for Factor 1), demonstrating that the PCSES items cover a wide range of the construct (self-efficacy). In addition, as shown in Table 3, these data suggest that the PCSES items tended to be endorsed, meaning that the sample tended to agree with the content in the items. These findings agree with Nam et al.'s (2011) and Miguel et al.'s (2013) findings, particularly regarding the level of difficulty of the items (i.e., the level of the items in the latent construct; they reported that the person mean was higher than the item mean, and corroborate our second hypothesis.

Table 3 Summary of the descriptive statistics for the items

	N	b	SE	Infit	Outfit	Item-theta correlation
Factor 1—self-appraisal						
Mean	876.8	.00	.05	1.01	1.01	.43–.61
SD	3.0	.31	.00	.15	.16	
Maximum	881.0	.39	.06	1.47	1.48	
Minimum	870.0	−.70	.05	.83	.80	
Factor 2—gathering occupational information						
Mean	879.9	.00	.05	1.01	1.00	.53–.62
SD	2.1	.31	.00	.10	.10	
Maximum	883.0	.45	.05	1.15	1.16	
Minimum	875.0	−.48	.04	.79	.76	
Factor 3—practical professional information search						
Mean	877.9	.00	.05	1.00	1.00	.50–.62
SD	2.5	.23	.00	.12	.14	
Maximum	883.0	.43	.05	1.19	1.24	
Minimum	874.0	−.48	.05	.82	.82	
Factor 4—future planning						
Mean	879.0	.00	.06	1.00	1.00	.59–.68
SD	2.2	.20	.00	.12	.11	
Maximum	882.0	.32	.06	1.14	1.13	
Minimum	876.0	−.38	.05	.79	.78	

The averages of the fit indices for the items were shown to be adequate, i.e., below 1.20. However, the maximum infit and outfit indices suggest that at least one item for Factors 1 and 3 was incongruous in terms of what is expected from the model and the observed data. Specifically, one item (“Choose a profession even if your parents do not agree,” from Factor 1) showed both infit and outfit values of greater than 1.20 and one item (“Find out how long a person takes to get a job in the field in which you are interested,” from Factor 3) with only the outfit index above 1.20. Moreover, point-measure correlations indicate high magnitudes of correlation between groups of items and their scales (ranging from .43 to .68). Table 3 presents only the range of correlation coefficients for each scale. In terms of continuity, Figure 1 provides data obtained from the analysis of the response categories from the four subscales.

Figure 1 shows the probabilities of endorsing each of the response categories and how these are mapped at different levels of theta to an item with $b_i = 0$ (i.e., a difficulty level equal to zero). The intersection between two categories can be understood as the threshold value of the transition between the categories. The threshold between categories 1 and 2 was equal to -1.14 , that between 2 and 3 was equal to $-.19$, and that between 3 and 4 was equal to 1.33 . A clear representation of all categories was observed, as previewed in our third hypothesis. The non-

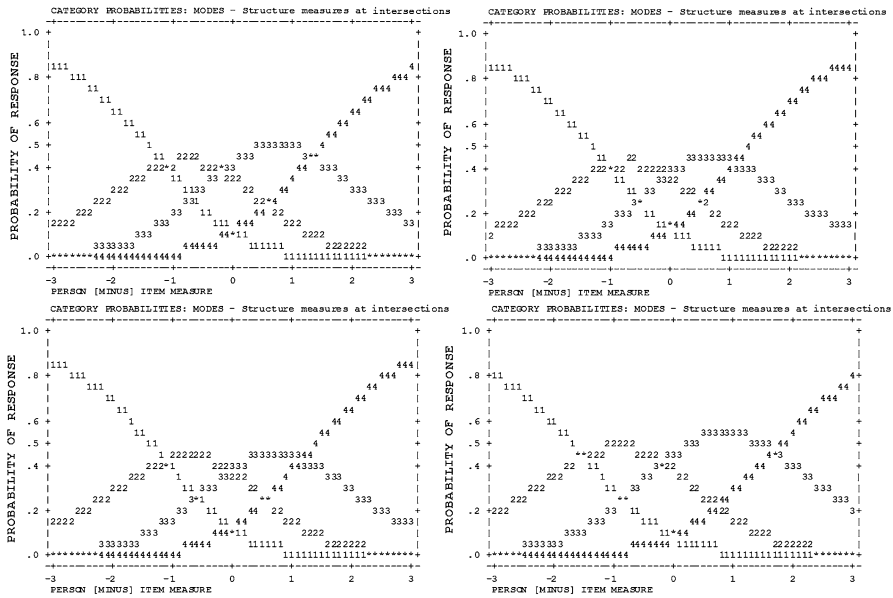


Figure 1 Response categories for the four PCSES subscales. The *upper left* and *right* plots refer to Factor 1 (self-appraisal) and Factor 2 (gathering occupational information), respectively; the *bottom left* and *right* plots refer to Factor 3 (practical professional information search) and Factor 4 (future planning), respectively

overlapping peaks of the curves, i.e., the separation of these different regions associated with each scalar value, is a desirable metric feature, and these empirical data show that the responses to the items could be modeled quantitatively by a monotonic relationship increasing between theta and the scalar category (Linacre, 2011).

Discussion

In this study, we reported analyses based on a specific IRT Rasch model for the PCSES, a Brazilian instrument constructed based on the literature relevant to the CDSE. One of the main arguments in the literature concerns the structure of this construct. As reported earlier, there are several proposals regarding the structure, and the most robust findings converge for a one-factor structure, especially when it comes from the CDSE-SF, with 25 items.

First, we verified the unidimensionality possibility, and it was unfounded. The non-unidimensionality of the full set of items is convergent with previous results (Ambiel & Noronha, 2012), indicating that the PCSES is better explained by a four-factor solution. This finding corroborates our first hypothesis and contributes to discussions about the dimensionality of self-efficacy applied to career choice, corroborating the original structure of the PCSES (Ambiel & Noronha, 2012) and

supporting Chaney et al.'s (2007) findings concerning the number of factors, albeit using different content and a different extraction technique. By contrast, Nam et al. (2011) and Miguel et al. (2013) found one general factor also using the PCA of standardized residuals.

Based on that, we performed the analysis and observed that the sample tended to show a lower level in the latent construct (self-efficacy) compared to the construct level of the items. Although the average latent trait level of the participants was low, meaning that most of them tended to endorse/agree with the items, all scales had adequate variability (see theta *SD*), suggesting that the sample included both people with both high and low self-efficacy. Furthermore, although the means and standard deviations suggest that most of sample did not exceeded the misfit cut-off, indicating that just a few of respondents showed misfit, the maximum infit and outfit values tell us that the expected model parameters for some participants could not adequately represent the responses observed in the scales. Because of that, it was not necessary to apply exclusion criteria to the sample.

We also verified the items' parameters, and our data supported that from Nam et al. (2011) and Miguel et al. (2013), particularly regarding the level of difficulty of the items (i.e., the level of the items in the latent construct); they reported that the person mean was higher than the item mean, which corroborates our second hypothesis. In relation to the misfit indexes, the data indicated that two items (from Factor 1 and 3) potentially should be dropped from the PCSES. But, the analysis should be replicated with other samples to examine whether the data are convergent or not. This is similar to the studies by Nam et al. (2011) and Miguel et al. (2013), with two and one item being beyond the fit limit established, respectively.

In the final analysis, we verified the categories' response function, and found that the respondents were using the categories correctly and in a similar way, as postulated in our third hypothesis. In the case of the CDSE, a five-point Likert-type scale is used, and Nam et al. (2011) and Miguel et al. (2013) found similar results.

We effectively presented an instrument with a unique structural configuration in studies of career decision self-efficacy, with four factors supported by the Rasch-Andrich rating scale model. Furthermore, similar to other studies based on this mathematical model, we found that the items of career decision self-efficacy scales seem to be easily endorsed by respondents. It means that on a 4-point Likert-type scale (*1 = no confidence, 4 = much confidence*), items tended to elicit responses closer to participants reporting having plenty of confidence rather than a lack of confidence.

Thus, a question is posed. When evaluating the sense of one's ability to engage in tasks related to career decisions, the PCSES items may not be representing challenges for respondents, as Bandura (2006) suggested. If this is true, practical consequences may be observed, such as an inconsistent estimative of the construct when the PCSES is used to plan and evaluate interventions. In future research, new sets of more challenging items should be tested to extend the range of answers. Another limitation of this study is that we did not control for participants' simultaneous participation in interventions related to career choice or for the possibility of participants declaring low levels of certainty about career choice. In the future, the diagnostic potential of the PCSES should be tested in experimental

samples, such as Di Fabio and Maree's (2012) in clinical situations and Talib et al.'s (2014) in educational interventions.

In future studies, researchers can overcome these limitations and address other potential avenues by checking possible differential functioning of the items by gender and by differing levels of vocational indecision. Additionally, the factorial structure should be verified for the PCSES in other samples using different approaches, such as confirmatory factorial analysis. Finally, considering that the PCSES was constructed in Brazil, it would be interesting to compare the similarity of this assessment with the Portuguese version of the CDSE used by Miguel et al. (2013).

References

- Ambiel, R. A. M., & Noronha, A. P. P. (2011). Construção dos itens da Escala de Autoeficácia para Escolha Profissional [Construction of professional choice self-efficacy scale items]. *Psico-USF, 16*, 23–32.
- Ambiel, R. A. M., & Noronha, A. P. P. (2012). *Escala de autoeficácia para escolha profissional: manual técnico [Professional choice self-efficacy scale: Technical manual]*. São Paulo, Brazil: Casa do Psicólogo.
- Andrews, L. M., Bullock-Yowell, E., Dahlen, E. R., & Nicholson, B. C. (2014). Can perfectionism affect caerer development? Exploring career thoughts and self-efficacy. *Journal of Counseling and Development, 92*, 270–279. doi:10.1002/j.1556-6676.2014.00155.x.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavior change. *Psychological Review, 84*, 191–215. doi:10.1037/0033-295X.84.2.191.
- Bandura, A. (2006). Guide for constructing self-efficacy scales. In F. Pajares & T. C. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 307–337). Greenwich, CT: Information Age Publishing.
- Betz, N. E., Klein, K. L., & Taylor, K. M. (1996). Evaluation of a short form of the career decision-making self-efficacy scale. *Journal of Career Assessment, 4*, 47–57. doi:10.1177/106907279600400103.
- Betz, N. E., & Taylor, K. M. (2012). *Career decision self-efficacy scale: Manual and sampler set*. Menlo Park, CA: Mind Garden.
- Chaney, D., Hammond, M. S., Betz, N. E., & Multon, K. D. (2007). The reliability and factor structure of the career decision self-efficacy scale-SF with African Americans. *Journal of Career Assessment, 15*, 194–205. doi:10.1177/1069072706298020.
- Creed, P., Patton, W., & Prideaux, L. A. (2006). Causal relationship between career indecision and career decision-making self-efficacy. *Journal of Career Development, 33*, 47–65. doi:10.1177/0894845306289535.
- Creed, P. A., Patton, W., & Watson, M. B. (2002). Cross-cultural equivalence of the career decision-making self-efficacy scale-short form: An Australian and South African comparison. *Journal of career assessment, 10*, 327–342. doi:10.1177/10672702010003004.
- Crites, J. O. (1961). A model for measurement of vocational maturity. *Journal of Counseling Psychology, 8*, 255–259. doi:10.1037/h0048519.
- Crites, J. O. (1978). *Theory and research handbook for the career maturity inventory*. Monterey, CA: CTB/McGraw-Hill.
- Di Fabio, A., & Maree, J. G. (2012). Group-based life design counseling in an Italian context. *Journal of Vocational Behavior, 80*, 100–107. doi:10.1016/j.jvb.2011.06.001.
- Embretson, S. E., & Reise, S. P. (2000). *Item response theory for psychologists*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Fouad, N., Cotter, E. W., & Kantamneni, N. (2009). The effectiveness of a career decision-making course. *Journal of Career Assessment, 17*, 338–347. doi:10.1177/1069072708330678.
- Gaudron, J. P. (2011). A psychometric evaluation of the career decision self-efficacy scale-short form among French university students. *Journal of Career Assessment, 19*, 420–430. doi:10.1177/1069072711409713.

- Hackett, G., & Betz, N. E. (1981). A self-efficacy approach to the career development of women. *Journal of Vocational Behavior*, 18, 326–336. doi:10.1016/00018791(81)90019-1.
- Hambleton, H. K., & Swaminatham, H. (1985). *Item response theory: Principles and applications*. Boston, MA: Kluwer.
- Hambleton, R. K., & Van der Liden, W. J. (1982). Advances in item response theory and applications: An introduction. *Applied Psychological Measurement*, 4, 373–378.
- Hampton, N. Z. (2006). A psychometric evaluation of the career decision self-efficacy scale-short form in Chinese high schools students. *Journal of Career Development*, 33, 142–155. doi:10.1177/0894845306293540.
- Jin, L., Ye, S., & Watkins, D. (2012). The dimensionality of the career decision self-efficacy scale-short form among Chinese graduate students. *Journal of Career Assessment*, 20, 520–529. doi:10.1177/1069072712450492.
- Lent, R. W., Brown, S. D., & Hackett, G. (1994). Towards a unifying social cognitive theory of career and academic interests, choice and performance. *Journal of Vocational Behavior*, 45, 79–122. doi:10.1006/jvbe.1994.1027.
- Linacre, J. M. (2011). *Winsteps rasch measurement*. Version 3.71 [Computer software]. Retrieved from <http://www.winsteps.com>.
- Linacre, J. M., & Tennant, A. (2009). More about critical Eigenvalue sizes (variances) in standardized-residual principal components analysis (PCA). *Rasch Measurement Transactions*, 23, 1228.
- Lo Presti, A., Pace, F., Mondo, M., Nota, L., Casarubia, P., Ferrari, L., & Betz, N. E. (2013). An examination of the structure of the career decision self-efficacy scale (short form) among Italian high school students. *Journal of Career Assessment*, 21, 337–347. doi:10.1177/1069072712471506.
- Metheny, J., & McWhirter, E. H. (2013). Contributions of social status and family support to college student's career decision self-efficacy and outcome expectations. *Journal of Career Assessment*, 21, 378–394. doi:10.1177/1069072712475164.
- Miguel, J. P., Silva, J. T., & Prieto, G. (2013). career decision self-efficacy scale—short form: A Rasch analysis of the Portuguese version. *Journal of Vocational Behavior*, 82, 116–123. doi:10.1016/j.jvb.2012.12.001.
- Miller, M. J., Roy, K. S., Brown, S. D., Thomas, J., & McDaniel, C. (2009). A confirmatory test of the factor structure of the short form of the career decision self-efficacy scale. *Journal of Career Assessment*, 17, 507–519. doi:10.1177/1069072709340665.
- Nam, S. K., Yang, E., Lee, S. M., Lee, S. H., & Seol, H. (2011). A psychometric evaluation of the career decision self-efficacy scale with Korean students: A Rasch model approach. *Journal of Career Development*, 38, 147–166. doi:10.1177/0894845310371374.
- Page, J., Bruch, M. A., & Haase, R. F. (2008). Role of perfectionism and five-factor model traits in career indecision. *Personality and Individual Differences*, 45, 811–815. doi:10.1016/j.paid.2008.08.013.
- Peterson, S. L., & delMas, R. C. (1998). The component structure of career decision-making self-efficacy for underprepared college students. *Journal of Career Development*, 24, 209–225. doi:10.1177/089484539802400304.
- Ramírez, M. C., & Canto, J. E. (2007). Development and evaluation of a scale for measuring self-efficacy in career choice in Mexican students. *Electronic Journal of Research in Educational Psychology*, 5, 37–56.
- Reese, R. J., & Miller, C. D. (2006). Effects of a university career development course on career decision-making self-efficacy. *Journal of Career Assessment*, 14, 252–266. doi:10.1177/1069072705274985.
- Silva, J. T., Paixão, M. P., & Albuquerque, A. M. (2009). Características psicométricas da versão portuguesa da Career decision self-efficacy scale-short form (CDSE-SF) [Psychometric characteristics of the Portuguese version of career decision self-efficacy scale-short form, CDSE-SF]. *Psychologica*, 51, 27–46.
- Srsic, C. S., & Walsh, W. B. (2001). Person-environment congruence and career self-efficacy. *Journal of Career Assessment*, 9, 203–213. doi:10.1177/106907270100900207.
- Talib, J. A., Salleh, A., Amat, S., Ghavifekr, S., & Ariff, A. M. (2014). Effect of career education module on career development of community college students. *International Journal for Educational and Vocational Guidance*. Advance on line publication. doi:10.1007/s10775-014-9279-x.
- Taylor, K. M., & Betz, N. E. (1983). Applications of self-efficacy theory to the understanding and treatment of career indecision. *Journal of Vocational Behavior*, 22, 63–81. doi:10.1016/0001-8791(83)90006-4.

- Walton, K. E., Roberts, B. W., Krueger, R. F., Blonigen, D. M., & Hicks, B. M. (2008). Capturing abnormal personality with normal personality inventories: An item response theory approach. *Journal of Personality, 76*, 1623–1648. doi:[10.1111/j.1467-6494.2008.00533.x](https://doi.org/10.1111/j.1467-6494.2008.00533.x).
- Wang, J., Zhang, D., & Shao, J. (2010). Group training on the improvement of college students' career decision-making self-efficacy. *Health, 2*, 551–556. doi:[10.4236/health.2010.26082](https://doi.org/10.4236/health.2010.26082).
- Watson, M. B., Brand, H. J., Stead, G. B., & Ellis, R. R. (2001). Confirmatory factor analysis of the career decision-making self-efficacy scale among south African university students. *Journal of Industrial Psychology, 27*, 43–46. doi:[10.4102/sajip.v27i1.774](https://doi.org/10.4102/sajip.v27i1.774).
- Wolfe, E. W., & Smith, E. V, Jr. (2007). Understanding Rasch measurement: Instrument development tools and activities for measure validation using Rasch models: Part II—validation activities. *Journal of Applied Measurement, 8*, 204–234.
- Wright, B. D., & Linacre, J. M. (1994). Reasonable mean-square fit values. *Rasch measurement transaction, 8*, 370.
- Wright, B. D., & Masters, G. N. (1982). *Rating scale analysis*. Chicago: MESA Press.