

Development and psychometric properties of the Nonverbal Vocational Interest Scale (NVIS)

Regina Weißmann, Ulrich Bartosch & Joachim Thomas |

To cite this article: Regina Weißmann, Ulrich Bartosch & Joachim Thomas | (2022) Development and psychometric properties of the Nonverbal Vocational Interest Scale (NVIS), Cogent Education, 9:1, 2084957, DOI: [10.1080/2331186X.2022.2084957](https://doi.org/10.1080/2331186X.2022.2084957)

To link to this article: <https://doi.org/10.1080/2331186X.2022.2084957>



© 2022 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.



Published online: 06 Jun 2022.



Submit your article to this journal [↗](#)



Article views: 332



View related articles [↗](#)



View Crossmark data [↗](#)



Received: 08 March 2022
Accepted: 30 May 2022

*Corresponding author: Regina Weißmann, Catholic University of Eichstaett-Ingolstadt, Department for Psychological Diagnosis and Intervention, Ostenstraße 27, 85072 Eichstätt, Germany
E-mail: regina.weissmann@ku.de

Reviewing editor:
May Cheng, Education University of Hong Kong, Hong Kong

Additional information is available at the end of the article

PROFESSIONAL EDUCATION & TRAINING | RESEARCH ARTICLE

Development and psychometric properties of the Nonverbal Vocational Interest Scale (NVIS)

Regina Weißmann^{1*}, Ulrich Bartosch² and Joachim Thomas^{1,2}

Abstract: Vocational interest inventories play an important role in supporting adolescents and young adults in their vocational choice. However, existing verbal and pictorial questionnaires have limitations regarding the complexity, abstraction level, and ambiguity of the item material. The presented research attempts to overcome these limitations by developing a new pictorial questionnaire. Study 1 describes the construction process of the Nonverbal Vocational Interest Scale (NVIS) and its psychometric properties, evaluation, and construct validation. Data from $N = 363$ adolescents and young adults in lower secondary school and vocational training centres were considered. Study 2 was conducted to confirm convergent and discriminant validity. $N = 237$ adolescents and young adults completed the revised form of the NVIS and the Photo-Interest-Inventory (F-I-T). The results confirm that the NVIS is a reliable and valid computer-based instrument for assessing vocational interests. Limitations and implications for further research and use in vocational training and counselling settings are discussed.

Subjects: Teaching & Learning - Education; Vocational Education; Testing, Measurement and Assessment; Test Development, Validity & Scaling Methods; Counseling Psychology; Career & Lifestyle Development; Emotional & Behavioural Difficulties; Language & Communication Difficulties; Learning Difficulties; Careers Guidance

Keywords: Vocational interests; pictorial inventories; career decision; vocational counselling; scale development

1. Introduction

Learning to identify vocational interests plays a major role in the development of adolescents' career perspectives and the vocational decision-making process. Therefore, the psychological assessment of interests is one of the main issues in vocational counselling and orientation settings (Brown & Ryan Krane, 2000).

ABOUT THE AUTHORS

Regina Weißmann is a postdoctoral researcher at the Department of Psychological Diagnosis and Intervention at the Catholic University of Eichstaett-Ingolstadt. Her research interests focus on vocational rehabilitation of adolescents and young adults, the transition from school to work, and research on the International Classification of Functioning, Disability and Health (ICF)

Ulrich Bartosch is a professor of pedagogy at the Catholic University of Eichstaett-Ingolstadt. Since 2020, he has been president of the University of Passau in Bavaria, Germany. His research focuses on inclusion, participation, higher education and curriculum reform, as well as competency and skills assessment

Joachim Thomas is a professor in the Department of Psychological Diagnosis and Intervention at the Catholic University of Eichstaett-Ingolstadt. His research interests focus on vocational rehabilitation, work and health, transition from school to work, migration and intercultural psychology.

The present study focuses on the development of a pictorial instrument for exploring the vocational interests of adolescents and young adults who are challenged in their vocational decision-making process. The questionnaire aims to support a self-determined exploration of vocational interests to allow adolescents and young adults to choose a suitable apprenticeship. It essentially addresses two groups: first, students preparing for the transition from school to vocational apprenticeship; second, young people who have not made a smooth transition from school to work and who visit vocational training centres to form new perspectives. These target groups face particular challenges in making career decisions for various reasons. Among the issues discussed are mental and learning impairment, poor academic qualifications, low socioeconomic status, and language barriers (Gebhardt et al., 2011; Haasler, 2020; Ochs & Roessler, 2001).

2. Theoretical background

2.1. *The role of vocational interests in the vocational decision-making process*

Following the definition of Sackett et al. (2017), “vocational interests reflect individual differences in people’s preferences for certain types of work activities and environments” (p. 263). A positive outcome of vocational interests can emerge when individual interests coincide with a person’s field of work or field of study (Hanna & Rounds, 2020). Based on the person-environment fit theory of occupational choice (Holland, 1966), this interest congruence leads to several positive job-related outcomes, indicating that vocational interests are an important predictor of a successful career (Rounds & Su, 2014). Several meta-analyses (Nye et al., 2017; Van Iddekinge, Putka et al., 2011; Van Iddekinge, Roth et al., 2011) have shown that congruence between vocational interests and the working environment has a high impact on employees’ job performance. Further studies emphasise vocational interests as a meaningful predictor of gross income and full-time employment (Stoll et al., 2017), academic achievement (Patrick et al., 2011), the sustainability of occupational choices and job satisfaction (Hansen, 2005), and subjective well-being (Harris & Rottinghaus, 2015). Furthermore, studies have found correlations between vocational interests and other job-related personality traits, such as professional choice self-efficacy (Whiston et al., 2017), motivation (Rajitha, 2016), and persistence (Fouad et al., 2016).

Additionally, the negative aspects of ignoring vocational interests in the context of vocational orientation have been widely examined. A study among adolescents in Germany revealed that a mismatch between interests and apprenticeship content is among the major reasons for abandoning vocational training (BMBF, 2009). Experiencing this incongruence has previously been associated with students’ disappointment, depression, frustration, stress, anxiety (Kim et al., 2019), job burnout (Brandstätter et al., 2016), and higher risk of unemployment (Gerber-Schenk et al., 2010). Consequently, several researchers have called for an increased “awareness concerning the potential usefulness of vocational interests for selection” (Van Iddekinge, Putka et al., 2011, p. 14).

2.2. *Assessment of vocational interests*

In general, interest inventories show high predictive validity for vocational choice (Hanna & Rounds, 2020). They can support clients in specifying or confirming their vocational interests or obtaining a new focus on areas of interest they had not yet considered (Hansen, 2005). The analysis of vocational interests is usually accomplished by measuring interest congruence, which is the result of matching individuals’ interests with their current or future workplace (Hanna & Rounds, 2020). In his approach to career development, Super (1983) encourages clients’ active role in the counselling process. Therefore, instruments should enable individuals to explore and examine their own abilities and interests to promote a self-directed and self-responsible vocational choice (Luttenberger et al., 2014).

2.2.1. *Verbal vocational interest assessment: current measures and their limitations*

Vocational interest questionnaires usually use verbal items (Proyer & Häusler, 2007). Most verbal inventories are based on the RIASEC model of Holland (1997). The model assumes six personality types from which different vocational interests can be derived and six corresponding types of

environments to characterise working surroundings. The six personality types are realistic (R), investigative (I), artistic (A), social (S), enterprising (E), and conventional (C). According to Neukrug et al. (2013), the Strong Interest Inventory (SII; Donnay et al., 2005) and the Self-Directed Search (SDS; Holland & Messer, 2013), which are both based on the RIASEC model, are the most popular instruments in career counselling settings in the United States and have been adapted worldwide.

One major issue of all language-based instruments for assessing vocational interests is that their validity and the interpretation of items strongly depend on clients' reading skills and text comprehension (Boerchi & Magnano, 2015; Šverko et al., 2014). Schinka and Borum (1994) assume a reading level of sixth to eighth grade for common verbal interest inventories. Consequently, clients' literacy must be considered in diagnostic and research settings (McHugh & Behar, 2009).

Furthermore, verbal interest inventories usually consist of short, general and abstract statements. This is particularly challenging for adolescents with learning and mental impairments (Finlay & Lyons, 2001) or for clients with linguistic barriers (Laher & Cockcroft, 2017). In other words, common surveys for assessing personality that use decontextualised items risk excluding important target groups. A possible solution lies in formulating items in relation to the explicit activities and experiences of the target group (Smyly & Elsworth, 1997).

2.2.2. Pictorial vocational interest assessment: current measures and their limitations

To overcome the described difficulties of verbal instruments, the use of pictorial instruments with adequate norms, reliability, and validity is recommended (Elksnin & Elksnin, 1993; Ortner & Proyer, 2018). They are frequently used for individuals with reading difficulties and mental and learning impairments due to their alternative media approach (Stock et al., 2003). A review of nonverbal vocational interest inventories (Elksnin & Elksnin, 1993) refers to four inventories that are still used in career counselling settings. The Geist Picture Interest Inventory (GPII-R; Geist, 1988) and the Reading-Free Vocational Interest Inventory (R-FVII-R; Becker, 1981) use drawings as stimulus material, while the Pictorial Inventory of Careers (PIC; Kosuth, 1985) uses photographs. The stimulus material of the Career Assessment Survey Exploration (CASE; American Assessment Cooperation, 1982) consists of video and audio formats. Additionally, in recent test developments, there is no clear tendency to use photographs or drawings. To address the influence of gender stereotypes and the physical attractiveness of the model, the items of the Iconographic Professional Interest Inventory (3IP; Boerchi & Magnano, 2015) present professions as simple drawings without notable gender or facial expressions. The Pictorial Vocational Interest Inventory (PVII; Nurcahyo et al., 2019) also follows a drawing approach, but instead of a comprehensive presentation of a profession, it depicts concrete job-related activities. The Pictorial and Descriptive Interest Inventory (PDII; Šverko et al., 2014) presents labelled photographs of vocations together with a brief description. Clients are asked to evaluate their interest and to estimate whether they feel competent in executing this activity. In the Swiss Foto-Interessen Test [Photo-Interest Inventory] (F-I-T; Stoll et al., 2012), participants rate 132 photographs, each of which depicts a specific profession. The theoretical basis is provided by the RIASEC model (Holland, 1997) and the nine vocational fields of Egloff and Jungo (2012). In the construction of the PDII and F-I-T, the authors chose to use photographs to provide realistic pictures of professions and the associated work environment.

One problem with pictorial assessment is that pictures and photos can provide information that creates ambiguity (Šverko et al., 2014). Furthermore, a client's response might be affected by the subjective attractiveness of the depicted person (Boerchi & Magnano, 2015). Authors who have chosen the photographs of the PDII (Šverko et al., 2014) and the F-I-T (Stoll et al., 2012) have paid considerable attention to a realistic and comprehensive presentation of professions, which makes it difficult to identify the significant activity or object. Therefore, Nurcahyo et al. (2019) recommend reducing complexity by presenting one activity of a profession per item.

2.3. Implications for the construction of the NVIS

Based on the identified limitations derived from the literature review, the following implications for the design of NVIS items were established. To make the images clear and easy to understand, the photographs of the NVIS focus on one activity, which is displayed as a close-up shot. Nevertheless, it must be ensured that the photographs show familiar content to the target group. Therefore, the item collection included a phase of participative research (Bergold & Thomas, 2012) in which individuals from the target group were involved in providing feedback on the item choice and design.

Considering the aim of promoting self-determination (Luttenberger et al., 2014) and transparency (Super, 1983) in vocational orientation, it is important to use concrete, tangible, and self-explanatory categorisations of vocational interests. The RIASEC model (Holland, 1997) is the most prominent and most empirically confirmed model for the assessment of vocational interest. Additionally, research on the stability of vocational interests (Low et al., 2005), gender differences in vocational interests (Su & Rounds, 2015), and vocational interests as predictors of career success (Nye et al., 2017) is usually based on the RIASEC typology. Nevertheless, there are indications that the RIASEC model may not sufficiently reflect the vocational interests of adolescents with undifferentiated interest profiles. Research on adolescents who are in the beginning or the reorientation phase of their vocational orientation (Slot et al., 2020) shows that over 40% of these respondents have an undifferentiated interest profile according to the RIASEC typology and cannot be designated to one specific RIASEC profile. An appropriate alternative may be found in the vocational fields of Egloff and Jungo (2012), which refer to nine concrete vocational areas: 1. nature, 2. nutrition, 3. creative crafting, 4. building services, interior construction, and wood construction, 5. technical industry and technical crafts, 6. development, calculation, drafting, computer science, and investigation, 7. trading, administration, sales, traffic, economics, and safety, 8. language, literature, communication, theatre, music, cultural studies, and humanities, and 9. social, education, health, counselling, and care.

3. Study 1: scale development of the NVIS

Taking the outlined theoretical discourse, empirical findings, and derived implications into account, a new pictorial questionnaire for assessing vocational interests, the NVIS, was designed.

3.1. Method

3.1.1. Process of item collection

The basic principle in developing the NVIS was an openness to the impulses of the practice partners (the expert group and adolescents from the target group) who were involved in the developmental process of the NVIS. At the same time, it was important to derive implications for the design of the questionnaire from the literature review and published experiences with existing verbal and nonverbal vocational interest inventories. Both perspectives led to basic determinations regarding the included vocational areas, the design of the items as close-up photographs, and the response format.

The development of the NVIS included four steps following the recommendations of Worthington and Whittaker (2006): 1. literature and questionnaire review, 2. establishing the relevant vocational areas in group discussions with experts in the field of vocational orientation and rehabilitation, 3. creating an initial item pool, and 4. discussing and choosing the clearest and most unambiguous pictures with individuals from the target group through participative research.

Subsequent to the literature and questionnaire review, five independent experts involved in vocational counselling research and practice chose the relevant vocational areas for the questionnaire. The expert group agreed on nine vocational areas, which were similar to the model of Egloff and Jungo (2012): 1. agriculture and garden and landscape construction, 2. nutrition, gastronomy, and home economics, 3. creative crafts, 4. building industry, interior construction,

and wood technology, 5. industry and craft technology, 6. trading, administration, and economics, 7. sales, 8. education, social issues, and cosmetics, and 9. mathematics, chemistry, and computer technology. In the next step, a preliminary pool of photographs was selected by the research team. It included 193 photographs, which were matched to one of the nine vocational areas. In choosing the photographs, activity descriptions from different online job sites (i.e., the portal of the Federal Labour Office in Germany) were considered. To reduce the pool of photographs and to select the most suitable and understandable photographs, the target group of the questionnaire was included as an important source of input. Six group discussions were held with a total of $N = 22$ adolescents from a vocational preparation setting. Each group consisted of a minimum of three and a maximum of five discussants. For economic reasons and to minimise the workload for the participants, every group discussed pictures from three vocational areas. It was ensured that every vocational area was discussed in two distinctive groups. Before the beginning of the group discussions, all participants were informed about the purpose of the group discussion (identification of appropriate photographs for the development of a nonverbal questionnaire for assessing vocational interests) and the handling of the results (inclusion and exclusion of photographs in the further developmental process of the questionnaire). The leading questions for the group discussions were “Which activity do you see in the picture?”, “Which vocation does the activity in the picture represent?”, and “What is the focus of this picture?”. Pictures were considered for the questionnaire if our target group could identify the activity, assign the activity to a corresponding vocational area, and identify the focus of attention. From group discussions with the target group, 138 photographs were identified as suitable and understandable, from which the first version of the NVIS was formed. Consequently, 55 photographs were excluded. The main reasons for exclusion were that unknown machines were depicted, the activity could not be identified, no connection could be made between the activity and the associated vocational field, and too much information was visible so that it was unclear to what activity the photograph referred.

3.1.2. Measure

After the feedback of the target group was incorporated, the NVIS included a total of 138 items. A three-point scale in the form of a smiley scale was applied in the NVIS to reduce complexity (Simms et al., 2019) and to evoke more spontaneous responses (Schaik & Ling, 2007). Consequently, the pictures on the NVIS are rated on a three-point smiley scale ranging from 0 (= not interesting), 1 (=moderately interesting), and 2 (= very interesting). The smileys differ in expression (bad, moderate, and good mood) and in colour (red = not interesting, yellow = moderately interesting, and green = very interesting). An example item is shown in [figure 1](#).

3.1.3. Cut-offs for item reduction

Items were evaluated via item analysis (statistical power and item difficulty), internal consistency, and the results of two exploratory factor analyses (EFAs). The following rules were considered for item reduction. Discrimination power should be $r \geq .40$ (Sabri, 2013). For item difficulty, Metsämuuronen (2020) suggests deleting items with $P > 80$ or $P < 20$. Because an individual's vocational interests are usually strong in one to three vocational areas and low in all other areas, it can be expected that items are often evaluated as “not interesting”, which results in high item difficulties. Therefore, the cut-offs for item difficulty are defined as $90 < P > 10$. Furthermore, deleting an item should improve internal consistency (Cronbach's α), and items whose factor loadings are $< .40$ should be removed (Field, 2013). For reasons of test economy, items that are very similar are subject to removal; this decision is made in favour of the higher factor loading. Internal consistency in general should achieve at least $\alpha < .70$, following the criterion of Kaplan and Saccuzzo (2001) for acceptable reliability.

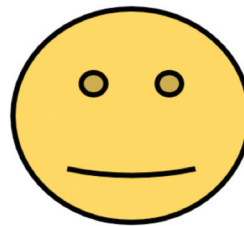
3.1.4. Participants

For the intended analysis, Rouquette and Falissard (2011) recommend a minimum sample size of 300 participants for factor analysis, which also served as a benchmark for the present study. The NVIS is intended to be a support for the career choice of young people who are still at the beginning of their vocational orientation as well as for adolescents and young adults who must

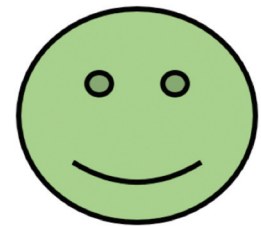
Figure 1. Sample item of the Nonverbal Vocational Interest Scale (NVIS). Scale 2: nutrition, gastronomy, and home-economics.



Not interesting



Moderately
interesting



Very interesting

find alternatives to their previous career preferences. Therefore, a broad sample was acquired. A total of $N = 363$ participants aged between 12 and 20 years ($M = 14.72$, $SD = 2.20$) completed the NVIS. The sample consisted of $N = 206$ (56.7%) male and $N = 157$ (43.3%) female participants, which represents the common distribution of gender in the involved institutions. A total of 13.6% of the participants were second-generation immigrants, mainly from Turkey, Italy, Romania, and Russia, who were born and raised in Germany.

$N = 281$ participants were attending lower secondary school at the time of the survey. They were between 12 and 16 years old and attended the seventh or eighth grade. These grades are particularly formative for vocational orientation in the German school system. An additional $N = 82$ participants had already left school and were completing a vocational preparation course at a vocational training centre. These participants were between 15 and 20 years old. Of these participants, 31.4% had left school without a degree, 54.3% had a degree from lower secondary school, and 14.3% had a higher degree.

3.1.5. Procedures

The study was approved by the Bavarian Ministry of Education and Cultural Affairs, the principals of the participating schools, and the head of the vocational training centre. All potential participants received oral and written information about the goals of the study, the assessment procedure, the handling of data, and the voluntary nature of participation. All underage students obtained a signed declaration of consent from their legal guardians in advance. The online-based survey was administered in the class/group context on desktop and mobile devices. After completing the

survey, participants received an explanation of the instrument and the 9 vocational areas. No further compensation was offered to the participants. The NVIS was prepared in LimeSurvey, which is open source software for online-based data collection. Participants were recruited by teachers and professional educators in the involved institutions.

3.1.6. Preliminary analysis

To ensure that the datasets were as complete as possible and that no items were inadvertently omitted, all items were classified as obligatory to answer. All participants were free to quit the survey at any time, but no participant claimed this opportunity. The evaluation of the results was conducted using IBM SPSS Statistics 25.

3.2. Results

3.2.1. Item analysis and EFA

The evaluation of item difficulty and discrimination power showed high to moderate item difficulty, ranging from $P = 4.0$ to $P = 42.5$. The five scales included a total of 21 items that did not meet the defined criterion of $10 < P < 90$. The range of discrimination power spanned from $r = .13$ to $r = .81$. In the next step, the analysis of internal consistency (Cronbach's α) was conducted. The results indicate that vocational areas 6 (trading, administration, and economics) and 9 (mathematics, chemistry, and computer technology) showed good internal consistency ($\alpha > .80$), according to Kaplan and Saccuzzo (2001). The other seven scales show excellent internal consistency ($\alpha > .90$). It was found that the elimination of a total of 13 items from 7 scales could lead to an improvement in internal consistency.

In further analysis, a maximum likelihood EFA was conducted for every scale to confirm the results of the item reduction via item analysis and internal consistency. The number of factors of each scale was determined to be 1. The Kaiser–Meyer–Olkin measure of sampling adequacy showed that all scales met the criterion of $KMO > .60$ (Kaiser, 1970), ranging between $KMO = .80$ and $KMO = .94$. The results of Bartlett's test of sphericity were significant for each scale, indicating that the scales were suitable for factor analysis (Bartlett, 1950). The analysis of the factor loadings showed that in scale 2 (nutrition, gastronomy, and home economics) and scale 3 (creative craft), there was one item on each scale with a factor loading $< .40$; these items were removed. In scale 6 (trading, administration, and economics), nine items did not satisfy the defined criterion of factor loadings $> .40$ (Field, 2013). Table 1 shows the internal consistency before item reduction, the range of item difficulty, the range of statistical power, and the range of factor loadings.

Based on the results of the different analysis steps, 37 items were removed from the questionnaire. Furthermore, the results of the EFA indicated that the previously assumed factor structure based on the nine vocational areas required revision. Consequently, scale 6 (trading, administration, and economics) was divided into two scales. They are referred to below as scale 6 (administration and economics), which essentially reflects classic office tasks, and scale 11 (storage and delivery), which includes more physical work, such as packing and delivering goods.

Scale 8 (education, social issues, and cosmetics) includes different activities in terms of content, which were summarised in one scale during the expert discussion. The results confirmed that the illustrated activities loaded stably on one scale. However, when the structure of the test was explained to the participants, they could not comprehend the connection between educational/social issues and activities related to cosmetics and beauty. Considering the application of the instrument in vocational counselling settings, it seemed reasonable to divide this scale into two separate scales, which appear as area 8 (education and social issues) and area 10 (cosmetics and beauty) in the following sections.

Taking these changes into account, a second analysis of internal consistency and a second maximum likelihood EFA were conducted. Table 2 shows the new internal consistency after item

Table 1. Results of the item analysis and exploratory factor analysis with the original item pool of the Nonverbal Vocational Interest Scale (NVIS)

Scale	Cronbach's α	Range of item difficulty	Range of discrimination power	Range of factor loadings	Explained variance
(1) Agriculture and garden and landscape construction	.94	12.0–26.0	.44–.78	.52–.81	53.4%
(2) Nutrition, gastronomy, and home economics	.90	5.5–34.5	.20–.73	.21–.77	36.1%
(3) Creative crafts	.90	8.0–28.0	.13–.73	.05–.88	40.7%
(4) Building industry, interior construction, and wood technology	.95	12.5–36.0	.54–.80	.54–.83	54.0%
(5) Industry and craft technology	.94	17.0–36.0	.56–.81	.56–.85	54.4%
(6) Trading, administration, and economics	.83	4.0–38.0	.28–.60	–.02–.89	26.1%
(7) Sales	.93	9.0–30.5	.44–.79	.43–.83	48.4%
(8) Education, social issues, and cosmetics	.94	6.5–33.0	.42–.74	.36–.93	43.0%
(9) Mathematics, chemistry, and computer technology	.85	14.542.5	.37–.71	.39–.82	34.5%

Table 2. Nonverbal Vocational Interest Scale (NVIS): Results after item reduction

Scale	Cronbach's α (after item reduction)	Range of factor loadings	Explained variance	New number of items
(1) Agriculture and garden and landscape construction	.93	.57–.81	55.2%	11
(2) Nutrition, gastronomy, and home economics	.90	.38–.86	46.6%	11
(3) Creative crafts	.86	.40–.90	43.3%	9
(4) Building industry, interior construction, and wood technology	.93	.51–.84	55.5%	13
(5) Industry and craft technology	.94	.65–.59	55.8%	13
(6) Administration and economics	.91	.61–.89	63.5%	7
(7) Sales	.84	.43–.84	55.1%	6
(8) Education, social issues, and cosmetics	.92	.40–.90	55.6%	8
(9) Mathematics, chemistry, and computer technology	.91	.41–.83	36.4%	9
(10) Cosmetics and beauty	.94	.56–.94	62.1%	10
(11) Storage and delivery	.83	.46–.91	44.8%	6

reduction, the results of the EFA, and the new number of items for each scale. The comparison between the first and the second analysis shows that all scales consisted of items that loaded at least .40 on the factor. Three scales reached good internal consistency ($\alpha > .80$), and eight scales showed excellent internal consistency ($\alpha > .90$) when the number of items was reduced from 138 to 101. Comparing the explained variance of the original and the revised scales (see, [Tables 1 and 2](#)), the results showed that all revised scales could explain more variance, especially those that were divided in the revision process.

3.2.2. Confirmatory factor analysis

To confirm the factor structure of the eleven vocational areas and to establish construct validity, a confirmatory factor analysis (CFA) was conducted in RStudio. For the comparative fit index, CFI $\geq .95$ is recommended as the criterion for a good model fit, and CFI $\geq .90$ is recommended as the criterion for an acceptable model fit (McDonald & Ho, 2002). Similar criteria are applicable for the Tucker–Lewis index (TLI). The root mean square error of approximation should be RMSEA $\leq .06$ (Hu & Bentler, 1999) for a good model fit. The standardised root mean square residual is acceptable if it is SMSR $\leq .80$ (Hooper et al., 2008). The Two-Index Presentation Strategy (Hu & Bentler, 1999) recommends a combination between RMSEA $\leq .06$ and SRMR $\leq .10$ to best avoid error rates. For the ratio of χ^2 and degrees of freedom (χ^2/df), Kline (2005) recommends a value < 3 .

The initial analysis provided sufficient quality results. The values of the CFI ($= .92$) and the TLI ($= .91$) indicate at least an acceptable model fit depending on whether a more or less conservative cut-off is used. The value for RMSEA ($= .06$) meets the criterion for a good model fit, while the SRMR ($= .09$) is not acceptable on its own considering the criterion of Hooper et al. (2008). When applying the two-index presentation strategy (Hu & Bentler, 1999), the cut-off values are met. The relative χ^2 ($= 2.43$) also meets the criteria. In general, the results confirm that the underlying structure of 11 factors represents a possible robust model of vocational interests.

4. Study 2: Validation of the NVIS

The revised version of the NVIS was included in a second study with a new, similar sample to examine further aspects of construct validity.

4.1. Method

4.1.1. Measures

The sample completed the revised form of the NVIS and the Photo Interest Inventory (F-I-T; Stoll et al., 2012). The NVIS, whose development was examined in the previous section, includes 101 items that represent 11 vocational areas. The F-I-T was used as an instrument for construct validation because of its similar scales, which represent the nine vocational fields of (Egloff & Junge, 2012).

4.1.2. Cut-offs for the examination of construct validity

One relevant aspect of construct validity is convergent validity, which states that tests or scales with similar constructs show moderate to high correlations. This can be investigated using similar scales of one instrument or using similar scales of different instruments (Gregory, 2007). Therefore, for the present study, it was assumed that scales of the NVIS that were similar in content showed moderate ($r > .30$) to high ($r > .50$) correlations. Although the fields of work differ, area 2 (nutrition, gastronomy, home economics) and area 7 (sales) of the NVIS, for example, show commonalities in terms of the extent of customer contact, service orientation, and physical strain. The comparison between area 8 (education and social issues) and area 10 (cosmetics and beauty) can serve as another example: both vocational areas are associated with a high amount of physical customer contact. Further positive moderate to high correlations are expected between area 4 (building industry, interior construction, and wood technology) and area 5 (industry and craft technology) because of their similar amount of physically demanding work, comparably little customer contact, and work on machines. Furthermore, it was assumed that scales of the NVIS and the F-I-T, which

are similar in content, show moderate ($r > .30$) to high ($r > .50$) correlations, e.g., between area 1 of the F-I-T (nature) and area 1 of the NVIS (agriculture and garden and landscape construction).

A further aspect of construct validity is found in the discriminant validity, which states that scales that are supposed to measure different constructs show low ($r < .30$) or no ($r < .10$) correlations (Hubley, 2014). With regard to the correlations between the NVIS scales, this was assumed to be the relationship between scale 1 (agriculture and garden and landscape construction) and scale 6 (administration and economics), since the former includes outdoor craft activities, and the latter refers primarily to typical office activities. Similarly, low ($r > .30$) to no ($r > .10$) correlations between the NVIS and F-I-T noncorresponding scales could be assumed, e.g., between area 10 of the NVIS (cosmetics and beauty) and area 6 of the F-I-T (development, calculation, drafting, computer science, and investigation).

Hubley (2014) emphasises that it is most important that “scores on discriminant measures [are] noticeably lower than correlations between scores on convergent measures” (p. 1665) and suggests interpreting both convergent and discriminant validity on correlation coefficients from the same sample. Therefore, the second study involved two tests that assessed vocational interests with a similar but not identical approach.

4.1.3. Participants

A total of $N = 239$ participants aged 13 to 20 years ($M = 14.82$, $SD = 2.33$) completed the NVIS and the F-I-T. They were recruited from the same institution involved in Study 1. The sample consisted of $N = 139$ (58.1%) male and $N = 100$ (41.9%) female participants. A total of 9.6% of the participants were second-generation immigrants, mainly from Turkey, who were born and raised in Germany. At the time of the survey, $N = 180$ of the participants attended lower secondary school and were between 13 and 16 years old, while $N = 59$ participants visited a preparation course at a vocational training centre and were between 16 and 19 years old. Thirty percent had left school without a degree, 52.7% had a degree from lower secondary school, and 16.4% had a higher degree.

4.1.4. Procedure

With regard to the design of Study 2, importance was attached to designing all parameters exactly as in Study 1. The survey was again conducted as an online-based survey in a class/group context on desktop and mobile devices. The study was approved by the Bavarian Ministry of Education and Cultural Affairs, the principals of the participating schools, and the head of the vocational training centre. All potential participants received oral and written information about the goals of the study, the assessment procedure, the handling of data, and the voluntary nature of participation. All underage students obtained a signed declaration of consent from their legal guardians in advance.

4.1.5. Preliminary analysis

To ensure that the datasets were as complete as possible, all items were classified as obligatory to answer. Datasets were included in the evaluation only when both the NVIS and the F-I-T were completely processed. All incomplete data were removed. The evaluation of the results was conducted in IBM SPSS Statistics 25.

4.2. Results

4.2.1. Convergent and discriminant validity: Pearson correlations between the scales of the NVIS

Table 3 shows the Pearson correlations between each of the 11 vocational areas. Correlations below $r = .30$ are interpreted as low, those higher than $r = .30$ are treated as moderate, and those higher than $r = .50$ are interpreted as high (Cohen, 1992). The results show that the corresponding areas of the NVIS correlate highly and positively with each other. For example, there is a correlation ($r = .75$) between area 2 (nutrition, gastronomy, and home economics) and area 7

Table 3. Pearson correlations between the eleven scales of the Nonverbal Vocational Interest Scale (NVIS)

	1	2	3	4	5	6	7	8	9	10	11
(1) Agriculture and garden and landscape construction	—										
(2) Nutrition, gastronomy, and home economics	.38**	—									
(3) Creative crafts	.47**	.54**	—								
(4) Building industry, interior construction, and wood technology	.50**	.01	.07	—							
(5) Industry and craft technology	.29**	-.04	.61	.78**	—						
(6) Administration and economics	.00	.20**	.21**	-.25**	-.14*	—					
(7) Sales	.40**	.75**	.45**	.04	-.01	.32**	—				
(8) Education and social issues	.12*	.54**	.50**	-.23**	-.30**	.21**	.45**	—			
(9) Mathematics, chemistry, and computer technology	.19**	.00	.09	-.49**	.69**	.17**	.00	.26**	—		
(10) Cosmetics and beauty	.27**	.55**	.47**	-.11*	-.16**	.19**	.46**	.55**	-.07	—	
(11) Storage and delivery	.55**	.28**	.23**	.57**	.50**	.10	.42**	-.01	.41**	.14**	—

** $p < .01$, * $p < .05$

Table 4. Pearson correlations between the scales of the Nonverbal Vocational Interest Scale (NVIS) and the Photo-Interest Inventory (F-I-T)

	FIT 1	FIT 2	FIT 3	FIT 4	FIT 5	FIT 6	FIT 7	FIT 8	FIT 9
NVIS 1	.67**	.41**	.23**	.50**	.21**	.18**	.24**	.07	.17*
NVIS 2	.44**	.78**	.27**	-.03	-.11	-.018	.27**	.22**	.46**
NVIS 3	.47**	.39**	.63**	.13*	.01	.12	.26**	.36**	.42**
NVIS 4	.18**	.12	.03	.89**	.66**	.33**	.10	-.17**	-.18**
NVIS 5	.01	.02	.06	.76**	.89**	.48**	.15*	-.10	-.24**
NVIS 6	-.02	.01	.34**	-.25**	-.08	.40**	.54**	.53**	.20**
NVIS 7	.44**	.67**	.27**	.01	-.09	.10	.44**	.24**	.43**
NVIS 8	.29**	.36**	.35**	-.24**	-.36**	-.18**	.08	.16*	.54**
NVIS 9	-.02	-.00	.21**	.48**	.71**	.66**	.30**	.19**	-.11
NVIS 10	.41**	.40**	.39**	-.14*	-.23**	-.02	.19**	.27**	-.80**
NVIS 11	.37**	.31**	.21**	.62**	.47**	.36**	.44**	.14*	.03

** $p < .01$, * $p < .05$, Scales of the NVIS: 1. agriculture and garden and landscape construction, 2. nutrition, gastronomy, and home economics, 3. creative crafts, 4. building industry, interior construction, and wood technology, 5. industry and craft technology 6. administration and economics, 7. sales, 8. education and social issues, 9. mathematics, chemistry, and computer technology, 10. cosmetics and beauty, 11. storage and delivery. Scales of the FIT: 1. nature, 2. nutrition, 3. creative crafting, 4. building services, interior construction, and wood construction, 5. technical industry and technical crafts, 6. development, calculation, drafting, computer science, and investigation, 7. trading, administration, sales, traffic, economics, and safety, 8. language, literature, communication, theatre, music, cultural studies, and humanities, 9. social, education, health, counselling, and care.

(sales) because both involve a high amount of service. Areas that have only some aspects in common show moderately positive correlations. For example, area 3 (creative crafts) and area 10 (cosmetics and beauty) share the creative component, but the latter involves much more physical contact with customers ($r = .47$). Areas that have no similar content in common, e.g., area 4 (building industry, interior construction, and wood technology) and area 7 (sales), show no correlation ($r = .04$). Some noncorresponding areas of the NVIS, such as area 8 (education and social issues) and area 5 (industry and craft technology), even show moderately negative correlations ($r = -.30$).

4.2.2. Convergent and discriminant validity: Pearson correlations between the scales of the NVIS and the F-I-T

Table 4 shows the Pearson correlations between the 11 areas of the NVIS and the 9 areas of the F-I-T. The results show that corresponding areas, e.g., area 4 on the NVIS (building industry, interior construction, and wood technology) and area 4 on the F-I-T (building services, interior construction, and wood construction), correlate very strongly ($r > .70$) and positively. Scales that have some aspects in common correlate positively and moderately ($r > .30$), e.g., area 2 on the NVIS (nutrition, gastronomy, and home economics) and area 9 on the F-I-T (social, education, health, counselling, and care). Areas that do not correspond to each other show low or no correlations. For example, no correlation is found between area 5 on the NVIS (industry and craft technology) and area 1 on the F-I-T (nature). Some noncorresponding areas, such as area 8 on the NVIS (education and social issues) and area 5 on the F-I-T (technical industry and technical craft), even show moderately negative correlations. NVIS and F-I-T scales that are similar in content show high correlations ($r > .50$); scales that are different in content show moderate, low or negative correlations ($r < .50$).

5. Discussion

This study aimed to develop a questionnaire for the pictorial assessment of vocational interests for adolescents and young adults who are at the very beginning of their vocational orientation or who have abandoned a former apprenticeship and therefore must reorient themselves by finding alternatives that correspond with their vocational interests. Therefore, the item material of the

NVIS aimed to depict clear, realistic, and familiar vocational activities. While the F-I-T (Stoll et al., 2012) gives a comprehensive impression of a profession per item, the NVIS aims to reduce complexity by focusing on one activity per item. In contrast to the PVII (Nurcahyo et al., 2019), which uses digital drawing pictures, the NVIS consists of photographs to provide the most realistic form of presentation.

As a result of the first study, an instrument is available that can provide adolescents with information on their vocational interests. It is worth noting that the participatory research approach (group discussions with participants from the target group) led to a useful preselection of photographs for the first version of the NVIS. In the expert group, nine relevant vocational areas were identified, which were depicted in the questionnaire. The results of the first study show that the selection of the vocational areas in the expert group and the classification of the photographs to the vocational areas by the research team proved to be largely successful. Nevertheless, the statistical evaluation of the first study led to further improvement of the NVIS by item reduction (138 to 101 items) and more precise differentiation of two vocational areas in terms of content. Compared to the previous structure with nine factors, the present version with eleven factors shows a good differentiation of the vocational field of trading from the field of administration and economics. Furthermore, due to the content, it seemed necessary to separate area 8 into the category of education and social issues and the category of cosmetics and beauty. The instrument achieved good to excellent internal consistency for all eleven scales. The eleven-factor structure was also confirmed by CFA. The CFI, TLI, two-index combination of SRMR and RMSEA, and relative χ^2 showed acceptable to good values with consideration of the common criteria and supported a robust factor structure.

In a second study, convergent and discriminant validity were investigated by considering the correlations between the NVIS scales and by determining the correlations between the NVIS scales and the F-I-T scales. The results showed moderate to high correlations between content-similar scales, which supports acceptable convergent validity. Vocational areas with dissimilar content, e.g., because one focused on work with machines and the other on work with customers, showed low or no positive and negative correlations. These results are comprehensible with the well-researched people-things dimension (Armstrong et al., 2008; Su et al., 2009).

5.1. Limitations

Some limitations of this study must be addressed. The reasons for not considering the RIASEC model were related to the main goals of NVIS, which are to promote self-determination (Luttenberger et al., 2014), assessment transparency, and clients' active participation (Super, 1983). The dimensions of the RIASEC model are very comprehensive but also very general and abstract; therefore, the RIASEC model may not sufficiently reflect the vocational interests of adolescents with an undifferentiated interest profile (Slot et al., 2020). For this reason, Egloff and Jungo's (2012) more differentiated and concretely formulated nine vocational fields were used as a basis for the experience-guided and discursive development of the NVIS. The findings of the study show that an even more differentiated solution can offer a suitable model, which was confirmed by the CFA. Nevertheless, future research should focus on investigating how the model can be adapted to the context of the RIASEC typology (Holland, 1997) or the people-things dimension (Armstrong et al., 2008; Su et al., 2009). Both could serve as superior factors in a hierarchical model to connect to the current scientific discourse on vocational interests.

A second limitation concerns the sample composition. The field of vocational guidance addresses a very broad target group that does not include only students who are still attending school. For this reason, it seemed important to conduct the presented studies with a broad sample that also included participants of out-school vocational preparation measures. However, future studies should focus on more specific samples with regard to age, institutional background, and impairment.

The results of both studies address the psychometric properties, construct validity, and convergent and discriminant validity of the NVIS. The results of vocational interest inventories can also show high predictive validity for vocational choices (Hanna & Rounds, 2020) and career success (Nye et al., 2017; Rounds & Su, 2014). No data are currently available to examine whether the NVIS is capable of providing predictions of these important aspects. To investigate predictive validity, future longitudinal research is necessary, for which the named studies can serve as models. In addition to career success, it seems particularly important for the target group of adolescents who have already experienced various discontinuities in their educational and vocational biographies to focus on the sustainability of vocational choices and job satisfaction (Hansen, 2005) as well as vocational choice self-efficacy (Whiston et al., 2017).

Further research should also address gender bias in the context of vocational interests (Šverko et al., 2014). The pictures for the NVIS were chosen by avoiding depicting persons in whole and instead focusing on their hands performing an activity. Furthermore, male and female images were balanced across the different vocational areas. For further studies, it is important to investigate whether the NVIS records vocational interests independently of gender.

Considering the identified limitations, various implications for future research emerge. This draws attention to an added value of the NVIS, which is that it enables research on the vocational interests of target groups that fall outside the scope of other interest inventories due to language barriers or the complexity of the item material. The different issues for future research that can be derived from the limitations of the present research can be validly investigated only with an instrument that is appropriate and understandable for the target group that faces particular challenges in the vocational decision-making process, e.g., due to language limitations or mental and learning impairment. The further use of the instrument in vocational interest research is supported by the development of the robust 11-factor model, which must be confirmed in further studies.

5.2. Implications for future practice-oriented research

The present study aimed to develop a pictorial instrument to support adolescents and young adults in exploring their vocational interests. A computer-based instrument was developed that allows adolescents at the beginning of their vocational orientation or in a reorientation process to obtain low-threshold access to their vocational interests because the NVIS requires almost no reading skills and no specific, detailed knowledge of different vocations. Various implications for future research have been addressed in the discussion of the limitations of the present research. Therefore, the following implications specifically target ideas for practice-based research.

Further work on the NVIS should especially address the development and evaluation of direct feedback after the survey, which fosters the active role of the client in the counselling process (Super, 1983). The ITC Guidelines on Quality Control in Scoring, Test Analysis, and Reporting of Test Scores (ITC) establish that clients should receive oral and written feedback concerning their results of psychological assessment. It must be ensured “that anyone who receives the scores has appropriate guidance in interpreting them, so there will be a proper understanding of test scores” (ITC, 2014, p. 24).

Further research should consider the implementation process of the NVIS in vocational counselling settings with respect to the role of professionals to strengthen their methodological perspective in promoting clients’ self-determination and active role in their vocational decision-making process. Here, participative research designs offer important access to the perspective of “those who are affected by the problem” (Bergold & Thomas, 2012, p. 200). It is important to “specify the decision-making situations in the research process, and the group of participants, and to disclose who, with what rights, at what point in time, and with regard to what theme, can participate in decisions” (Bergold & Thomas, 2012, p. 201). In selecting the photographs for the first version of the NVIS, the target group of the questionnaire was involved through group discussions. The

decision on which photographs were included in the first version of the questionnaire was significantly shaped by these participants, which can be evaluated positively with regard to participation. Nevertheless, it must be critically noted that the direct participation of the target group in the construction process of the NVIS was limited to the task of preselecting the most appropriate photographs from an existing pool of photographs. Further studies should consider at which points of the questionnaire construction process the target group can be additionally involved to take their expertise as co-researchers into account.

The NVIS, as one tool in the vocational counselling process, can support teachers, pedagogical specialists and career counselors in jointly identifying suitable internship positions and facilitating an anchor point for conversations about vocational interests. The implementation of the NVIS in the vocational counselling process can also enable future longitudinal research on the predictive validity of the NVIS.

By developing the NVIS, we hope to contribute to the research landscape of vocational assessment and stimulate the development of tests and instruments for vocational counselling. Similarly, we hope to contribute to the working field of vocational counselling and the use of vocational interest scales in the context of vocational assessment.

Acknowledgements

The authors would like to thank the 'Freising Bishop Conference' for funding the project and the members of the joint project 'Inclusive Living and Learning at School' for support and scientific counselling.

Funding

This research was funded by the "Freising Bishop Conference". The open access publication of this article was supported by the Open Access Fund of the Catholic University Eichstaett-Ingolstadt

Author details

Regina Weißmann¹

E-mail: regina.weissmann@ku.de

ORCID ID: <http://orcid.org/0000-0003-2287-2793>

Ulrich Bartosch²

Joachim Thomas¹²

ORCID ID: <http://orcid.org/0000-0001-6071-6252>

¹ Department of Psychological Diagnosis and Intervention, Faculty of Philosophy and Education, Catholic University of Eichstaett-Ingolstadt, Eichstaett, Germany.

² Department of Pedagogy, Faculty of Social Work, Catholic University of Eichstaett-Ingolstadt, Eichstaett, Germany.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

The data that support the findings of this research are available from the corresponding author (regina.weissmann@ku.de) upon reasonable request.

Citation information

Cite this article as: Development and psychometric properties of the Nonverbal Vocational Interest Scale (NVIS), Regina Weißmann, Ulrich Bartosch & Joachim Thomas, *Cogent Education* (2022), 9: 2084957.

References

- American Assessment Cooperation. (1982). *Career assessment survey exploration*.
- Armstrong, P. I., Day, S. X., McVay, J. P., & Rounds, J. (2008). Holland's RIASEC model as an integrative

framework for individual differences. *Journal of Counseling Psychology*, 55(1), 1–18. <https://doi.org/10.1037/0022-0167.55.1.1>

Bartlett, M. S. (1950). Test of significance in factor analysis. *British Journal of Statistical Psychology*, 3(2), 77–85. <https://doi.org/10.1111/j.2044-8317.1950.tb00285.x>

Becker, R. L. (1981). *Reading-free Vocational Interest Inventory – (R-FVII Revised)*. Elbern Publications.

Bergold, J., & Thomas, S. (2012). Participatory research methods: A methodological approach in motion. *Historical Social Research*, 37(4), 191–222. <https://doi.org/10.12759/hsr.37.2012.4.191-222>

BMBF. (2009). *Ausbildungsabbrüche vermeiden - neue Ansätze und Lösungsstrategien [Avoiding career dropouts - new approaches and solution strategies]*. Bertelsmann.

Boerchi, D., & Magnano, P. (2015). Iconographic Professional Interest Inventory (3IP): A new validation study. *Europe's Journal of Psychology*, 11(4), 571–596. <https://doi.org/10.5964/ejop.v11i4.927>

Brandstätter, V., Job, V., & Schulze, B. (2016). Motivational incongruence and well-being at the workplace: person-job fit, job burnout, and physical symptoms. *Frontiers in Psychology*, 7, 1153. <https://doi.org/10.3389/fpsyg.2016.01153>

Brown, S. D., & Ryan Krane, N. E. (2000). Four (or five) sessions and a cloud of dust: Old assumptions and new observations about career counseling. In S. D. Brown & R. W. Lent (Eds.), *Handbook of counseling psychology* (3rd ed., pp. 740–766). Wiley.

Cohen, J. (1992). Statistical power analysis. *Current Directions in Psychological Science*, 1(3), 98–101. <https://doi.org/10.1111/1467-8721.ep10768783>

Donnay, D. A. C., Morris, M. L., Schaubhut, N. A., & Thompson, R. C. (2005). *Strong Interest Inventory manual: Research, development and strategies for interpretation*. CPP.

Egloff, E., & Jungo, D. (2012). *Berufswahltagbuch [Career Choice Diary]*. Schulverlag.

Elksnin, L. K., & Elksnin, N. (1993). A review of picture interest inventories: Implications for vocational assessment of students with disabilities. *Journal of Psychoeducational Assessment*, 11(4), 323–336. <https://doi.org/10.1177/073428299301100403>

- Field, A. (2013). *Discovering statistics using IBM SPSS Statistics* (4th ed.). Sage.
- Finlay, W. M., & Lyons, E. (2001). Methodological issues in interviewing and using self-report questionnaires with people with mental retardation. *Psychological Assessment*, 13(3), 319–335. <https://doi.org/10.1037//1040-3590.13.3.319>
- Fouad, N. A., Singh, R., Cappaert, K., Chang, W.-H., & Wan, M. (2016). Comparison of women engineers who persist in or depart from engineering. *Journal of Vocational Behavior*, 92, 79–93. <https://doi.org/10.1016/j.jvb.2015.11.002>
- Gebhardt, M., Tretter, T., Schwab, S., & Gasteiger-Klicpera, B. (2011). The transition from school to the workplace for students with learning disabilities: Status quo and the efficiency of prevocational and vocational training schemes. *European Journal of Special Needs Education*, 26(4), 443–459. <https://doi.org/10.1080/08856257.2011.597181>
- Geist, H. (1988). *The Geist Picture Interest Inventory: Manual*. Western Psychological Services.
- Gerber-Schenk, M., Rottermann, B., & Neuenschwander, M. P. (2010). Passungswahrnehmung, Selbstkonzept und Jugendarbeitslosigkeit [Perception of fit, self-concept and youth unemployment]. In M. P. Neuenschwander & H.-U. Grunder (Eds.), *Schulübergang und Selektion* (pp. 112–1130). Ruegger.
- Gregory, R. J. (2007). *Psychological testing: History, principles, and applications*. Allyn & Bacon.
- Haasler, S. R. (2020). The German system of vocational education and training: Challenges of gender, academisation and the integration of low-achieving youth. *Transfer: European Review of Labor and Research*, 26(1), 57–71. <https://doi.org/10.1177/1024258919898115>
- Hanna, A., & Rounds, J. (2020). How accurate are interest inventories? A quantitative review of career choice hit rates. *Psychological Bulletin*, 146(9), 765–796. <https://doi.org/10.1037/bul0000269>
- Hansen, J.-I. C. (2005). Assessment of interests. In S. D. Brown & R. W. Lent (Eds.), *Career development and counseling: Putting theory and research to work* (pp. 281–304). Wiley.
- Harris, K. L., & Rottinghaus, P. J. (2015). Vocational interest and personal style patterns: Exploring subjective well-being using the Strong Interest Inventory. *Journal of Career Assessment*, 25(2), 203–218. <https://doi.org/10.1177/1069072715621009>
- Holland, J. L. (1966). *The psychology of vocational choice*. Blaisdell.
- Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments* (3rd ed.). Psychological Assessment Research Inc.
- Holland, J. L., & Messer, M. A. (2013). *The Self-Directed Search professional manual*. Psychological Assessment Resources.
- Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modeling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, 6(1), 53–60. <https://doi.org/10.21427/D7CF7R>
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Hubley, A. M. (2014). Discriminant validity. In A. C. Michalos (Ed.), *Encyclopedia of quality of life and well-being research* (pp. 1664–1667). Springer.
- ITC. (2014). *Guidelines on quality control in scoring, test analysis, and reporting of test scores*.
- Kaiser, H. F. (1970). A second generation little jiffy. *Psychometrika*, 35(4), 401–415. <https://doi.org/10.1007/BF02291817>
- Kaplan, R. M., & Saccuzzo, D. P. (2001). *Psychological testing: Principles, applications, and issues* (5th ed.). Thomson Learning.
- Kim, S. H., Park, S. K., & Lee, M. H. (2019). Effect of a nursing practice environment on nursing job performance and organizational commitment: Focused on the mediating effects of job embeddedness. *Journal of Korean Academy of Nursing Administration*, 25(3), 208–219. <https://doi.org/10.5392/JKCA.2019.19.02.661>
- Kline, R. B. (2005). *Methodology in the social sciences. Principles and practice of structural equation modeling* (2nd ed.). The Guilford Press.
- Kosuth, T. F. (1985). *The pictorial inventory of careers*. Talent Assessment.
- Laher, S., & Cockcroft, K. (2017). Moving from culturally biased to culturally responsive assessment practices in low-resource, multicultural settings. *Professional Psychology, Research and Practice*, 48(2), 115121. <https://doi.org/10.1037/pro0000102>
- Low, K. S. D., Yoon, M., Roberts, B. W., & Rounds, J. (2005). The stability of vocational interests from early adolescence to middle adulthood: A quantitative review of longitudinal studies. *Psychological Bulletin*, 131(5), 713–773. <https://doi.org/10.1037/0033-2909.131.5.713>
- Luttenberger, S., Aptarashvili, I., Ertl, B., Ederer, E., & Paechter, M. (2014). Niedrige Übereinstimmung zwischen Interessen und Berufswunsch – ein bislang vernachlässigtes Risiko in der Berufsorientierung Jugendlicher [Low agreement between interests and career aspirations – a so far neglected risk in the vocational orientation of young people]. *Gruppendynamik und Organisationsberatung*, 45(4), 359–377. <https://doi.org/10.1007/s11612-014-0252-4>
- McDonald, R. P., & Ho, M.-H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods*, 7(1), 64–82. <https://doi.org/10.1037/1082-989X.7.1.64>
- McHugh, R. K., & Behar, E. (2009). Readability of self-report measures of depression and anxiety. *Journal of Consulting and Clinical Psychology*, 77(6), 1100–1112. <https://doi.org/10.1037/a0017124>
- Metsämuuronen, J. (2020). Somers' D as an alternative for the item-test and item-rest correlation coefficients in the education measurement settings. *International Journal of Educational Methodology*, 6(1), 207–221. <https://doi.org/10.12973/ijem.6.1.207>
- Neukrug, E. S., Hamme Peterson, C., Bonner, M. W., & Lomas, G. I. (2013). A national survey of assessment instruments taught by counselor educators. *Counselor Education and Supervision*, 52(3), 207–221. <https://doi.org/10.1002/j.1556-6978.2013.00038.x>
- Nurcahyo, F. A., Azwar, S., Martani, W., & Kartowagiran, B. (2019). Development and psychometric properties of pictorial vocational interest inventory for Indonesian adolescents. *Electronic Journal of Research in Educational Psychology*, 17(47), 213–236. <https://doi.org/10.25115/ejrep.v17i47.2132>
- Nye, C. D., Su, R., Rounds, J., & Drasgow, F. (2017). Interest congruence and performance: Revisiting recent meta-analytic findings. *Journal of Vocational Behavior*, 98, 138–151. <https://doi.org/10.1016/j.jvb.2016.11.002>
- Ochs, L. A., & Roessler, R. T. (2001). Students with disabilities: How ready are they for the 21st century?

- Rehabilitation Counseling Bulletin*, 44(3), 170–176. <https://doi.org/10.1177/003435520104400307>
- Ortner, T. M., & Proyer, R. T. (2018). Behavioral and performance measures of personality. In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of personality and individual differences* (pp. 1–6). Springer International Publishing.
- Patrick, L., Care, E., & Ainley, M. (2011). The relationship between vocational interests, self-efficacy, and achievement in the prediction of educational pathways. *Journal of Career Assessment*, 19(1), 61–74. <https://doi.org/10.1177/1069072710382615>
- Proyer, R. T., & Häusler, J. (2007). Gender differences in vocational interests and their stability across different assessment methods. *Swiss Journal of Psychology*, 66(4), 243–247. <https://doi.org/10.1024/1421-0185.66.4.243>
- Rajitha, B. R. C. (2016). A study on the influence of achievement motivation on the vocational interests of adolescents. *International Journal of Science and Research*, 5(9), 1473–1476. https://www.ijsr.net/get_abstract.php?paper_id=ART20161931
- Rounds, J., & Su, R. (2014). The nature and power of interests. *Current Directions in Psychological Science*, 23(2), 98–103. <https://doi.org/10.1177/0963721414522812>
- Rouquette, A., & Falissard, B. (2011). Sample size requirements for the internal validation of psychiatric scales. *International Journal of Methods in Psychiatric Research*, 20(4), 235–249. <https://doi.org/10.1002/mpr.352>
- Sabri, S. (2013). Item analysis of student comprehensive test for research in teaching beginner string ensemble using model based teaching among music students in public universities. *International Journal of Education and Research*, 1(12), 1–14.
- Sackett, P. R., Lievens, F., Van Iddekinge, C. H., & Kuncel, N. R. (2017). Individual differences and their measurement: A review of 100 years of research. *Journal of Applied Psychology*, 102(3), 254–273. <https://doi.org/10.1037/apl0000151>
- Schaik, P. V., & Ling, J. (2007). Design parameters of rating scales for web sites. *ACM Transactions on Computer-Human Interaction*, 14(1), 1–35. <https://doi.org/10.1145/1229855.1229859>
- Schinka, J. A., & Borum, R. (1994). Readability of normal personality inventories. *Journal of Personality Assessment*, 62(1), 95–101. https://doi.org/10.1207/s15327752jpa6201_9
- Simms, L. J., Zelazny, K., Williams, T. F., & Bernstein, L. (2019). Does the number of response options matter? Psychometric perspectives using personality questionnaire data. *Psychological Assessment*, 31(4), 557–566. <https://doi.org/10.1037/pas0000648>
- Slot, E. M., Vulperhorst, J. P., Bronkhorst, L. H., van der Rijst, R. M., Wubbels, T., & Akkerman, S. F. (2020). Vocational interest profiles in secondary school: Accounting for multiplicity and exploring associations with future-oriented choices. *Journal of Educational Psychology*, 113(5), 1059–1071. <https://doi.org/10.1037/edu0000475>
- Smyly, S. R., & Elsworth, J. D. (1997). Interviewing clients: A project to explore client views about a change in service provision. *British Journal of Learning Disabilities*, 25(2), 64–67. <https://doi.org/10.1111/j.1468-3156.1997.tb00012.x>
- Stock, S., Davies, D., Secor, R. R., & Wehmeyer, M. (2003). Self-directed career preference selection for individuals with intellectual disabilities: Using computer technology to enhance self-determination. *Journal of Vocational Rehabilitation*, 19, 95–103.
- Stoll, F., Jungo, D., & Toggweiler, S. (2012). *Foto-Interessen-Test (F-I-T) [Photo-Interest-Inventory (F-I-T)]*. SDBB.
- Stoll, F., Rieger, S., Lüdtkke, O., Nagengast, B., Trautwein, U., & Roberts, B. W. (2017). Vocational interests assessed at the end of high school predict life outcomes assessed 10 years later over and above IQ and Big Five personality traits. *Journal of Personality and Social Psychology*, 113(1), 167–184. <https://doi.org/10.1037/pspp0000117>
- Su, R., Rounds, J., & Armstrong, P. I. (2009). Men and things, women and people: A meta-analysis of sex differences in interests. *Psychological Bulletin*, 135(6), 859–884. <https://doi.org/10.1037/a0017364>
- Su, R., & Rounds, J. (2015). All STEM fields are not created equal: People and things interests explain gender disparities across STEM fields. *Frontiers in Psychology*, 6, 1–20. <https://doi.org/10.3389/fpsyg.2015.00189>
- Super, D. E. (1983). Assessment in career guidance: Toward truly developmental counseling. *The Personnel and Guidance Journal*, 61(9), 555–562. <https://doi.org/10.1111/j.2164-4918.1983.tb00099.x>
- Šverko, I., Babarović, T., & Međugorac, V. (2014). Pictorial assessment of interests: Development and evaluation of Pictorial and Descriptive Interest Inventory. *Journal of Vocational Behavior*, 84(3), 356–366. <https://doi.org/10.1016/j.jvb.2014.02.008>
- Van Iddekinge, C. H., Roth, P. L., Putka, D. J., & Lanivich, S. E. (2011). Are you interested? A meta-analysis of relations between vocational interests and employee performance and turnover. *Journal of Applied Psychology*, 96(6), 1167–1194. <https://doi.org/10.1037/a0024343>
- Van Iddekinge, C. H., Putka, D. J., & Campbell, J. P. (2011). Reconsidering vocational interests for personnel selection: The validity of an interest-based selection test in relation to job knowledge, job performance, and continuance intentions. *Journal of Applied Psychology*, 96(1), 13–33. <https://doi.org/10.1037/a0021193>
- Whiston, S. C., Li, Y., Goodrich Mitts, N., & Wright, L. (2017). Effectiveness of career choice interventions: A meta-analytic replication and extension. *Journal of Vocational Behavior*, 100, 175–184. <https://doi.org/10.1016/j.jvb.2017.03.010>
- Worthington, R. L., & Whittaker, T. A. (2006). Scale development research: A content analysis and recommendations for best practice. *The Counseling Psychologist*, 34(6), 806–838. <https://doi.org/10.1177/001100000628812>



© 2022 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.

You are free to:

Share — copy and redistribute the material in any medium or format.

Adapt — remix, transform, and build upon the material for any purpose, even commercially.

The licensor cannot revoke these freedoms as long as you follow the license terms.

Under the following terms:

Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made.

You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

No additional restrictions

You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits.

Cogent Education (ISSN: 2331-186X) is published by Cogent OA, part of Taylor & Francis Group.

Publishing with Cogent OA ensures:

- Immediate, universal access to your article on publication
- High visibility and discoverability via the Cogent OA website as well as Taylor & Francis Online
- Download and citation statistics for your article
- Rapid online publication
- Input from, and dialog with, expert editors and editorial boards
- Retention of full copyright of your article
- Guaranteed legacy preservation of your article
- Discounts and waivers for authors in developing regions

Submit your manuscript to a Cogent OA journal at www.CogentOA.com

