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EDITED BY

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REVIEWED BY

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Leipzig University, Germany
María Teresa Fernandez Nistal,
Instituto Tecnológico de Sonora
(ITSON), Mexico

*CORRESPONDENCE

Michéle Möhring
✉ michelle.moehring@tu-dortmund.de

RECEIVED 06 January 2026

REVISED 05 May 2026

ACCEPTED 18 May 2026

PUBLISHED 08 June 2026

CITATION

Möhring M and Wild S (2026) Vocational interests among rehabilitation education students in Germany: a typological approach.
Front. Educ. 11:1782121.
doi: 10.3389/feduc.2026.1782121

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Vocational interests among rehabilitation education students in Germany: a typological approach

Michéle Möhring* and Steffen Wild

Rehabilitation Sciences, TU Dortmund University, Dortmund, Germany

Interest is a key driver of educational decisions and academic performance. Research on vocational interests among students in rehabilitation education is still limited. Therefore, this study examines the differentiation of vocational interests in rehabilitation education students based on the RIASEC model and explores factors associated with these interests. Data were collected from 140 students enrolled in bachelor's and master's programs of rehabilitation education across four German universities. A cluster analysis revealed three vocational interests groups: The Lower-Interest Group, the Creative-Inspired Group, and the Pragmatic-Analytical Group. Subsequent analyses indicate that the Big Five personality traits of agreeableness, neuroticism, and openness to experience are associated with these three interest groups. These findings provide a foundation for international comparative studies and offer practical implications for academic advising, helping study counselors guide (potential) students in their decisions regarding the rehabilitation education study program.

KEYWORDS

motivation, rehabilitation education, RIASEC, typology, vocational interests

Highlights

- Research is conducted on students in rehabilitation education, an understudied population.
- Three groups of vocational interests in rehabilitation education are identified: The Lower-Interest Group, the Creative-Inspired Group, and the Pragmatic-Analytical Group.
- The Big Five personality traits of agreeableness, neuroticism, and openness to experience are associated with the elaborated interest groups.
- We do a contribution for analyzing preconditions of academic success and performance in rehabilitation education.
- This study gives hints for making the learning process in rehabilitation education visible.

Introduction

Interests are key drivers of career choice, academic achievement, and well-being (Eccles and Wigfield, 2020; Grassinger et al., 2024). Within higher education research, the fit between a student's interest profile and their chosen program has been

associated with success (de Vries et al., 2024), satisfaction (Messerer et al., 2024), and lower dropout rates (Schnettler et al., 2020). Traditionally, these interests are often modeled using Holland's (1959, 1997), RIASEC typology (Realistic, Investigative, Artistic, Social, Enterprising, Conventional). While the RIASEC framework remains a cornerstone of vocational psychology, that has been found to be more influential for life goals than the Big Five personality traits in some studies (Stoll et al., 2020) and has been shown stability over time (Etzel and Nagy, 2021), recent scholarship identifies significant challenges in capturing the complexity of modern, interdisciplinary academic disciplines.

The research gap emerges from the increasing mismatch between the rigid six-type RIASEC model and the evolving nature of interdisciplinary professions (Deng et al., 2007; Williamson Fletcher, 2022). Specifically, the standard RIASEC types may be limited in capturing the professional complexity and hybrid profiles required in modern social science contexts (Hoff et al., 2024). Furthermore, there is an urgent call for culturally adapted typologies in non-US contexts to ensure the model's validity across different educational systems (Li et al., 2018). To address this gap, a person-oriented methodological approach is required. Unlike variable-centered methods that examine average relations across a population, a person-oriented approach, like cluster analysis or latent profile analysis, can be used to identify naturally occurring, multidimensional interest configurations within a specific student body (Bergman and Lundh, 2015; Spurk et al., 2020). This approach has been suggested as a suitable approach to identify "hybrid" interest types that traditional linear models might overlook, providing a more nuanced map of the professional identities emerging in complex fields.

Rehabilitation education in Germany represents a prime example of such interdisciplinary complexity, yet comprehensive research on the interest profiles within this field is still pending. Graduates in this field aim to "enable persons with disabilities to attain and maintain maximal independence, full physical, mental, social, and vocational ability, and full inclusion and participation in all aspects of life" (European Physical and Rehabilitation Medicine Bodies Alliance, 2018a, p. 127), a task that has been further complicated by political demands for inclusion and rapid digitalization (German Federal Employment Agency, 2025). Unlike traditional social science programs with clearly defined career paths, rehabilitation education is characterized by a highly diverse student body and a wide range of professional outlets. This diversity provides a relevant case for examining whether traditional interest models can still adequately predict student profiles and their prerequisites for success.

However, interests do not develop in a vacuum; they are deeply rooted in stable personality structures. According to the Five-Factor Model (Big Five), traits such as openness and agreeableness serve as dispositional bases that facilitate the development of specific vocational interests (Martins et al., 2024; Šverko and Babarović, 2016; Umucu et al., 2025). For instance, high levels of agreeableness are theoretically linked to social interests, while openness strongly predicts investigative and artistic leanings (Hurtado Rúa et al., 2019). In the context of rehabilitation education, that is a field defined by both scientific inquiry and empathetic social action, the Big Five can serve as a theoretical anchor to explain why certain interest profiles emerge and how they are sustained by underlying personality

dispositions. Including these traits allows for a holistic validation of the identified profiles, supporting the interpretation that they reflect relatively stable psychological patterns rather than transient preferences (Bleidorn et al., 2022; Seifert et al., 2022).

Consequently, this study addresses two central questions: (1) what specific interest profiles characterize students in rehabilitation education using a person-oriented approach, and (2) how do Big Five personality traits as well as demographic and structural factors serve as precursors to predict these interest profiles? By examining these questions, we contribute to a more differentiated understanding of vocational interests in interdisciplinary fields. Our findings aim to provide student counselors with better tools for advisory services and offer evidence-based suggestions for adapting curricula and learning environments to better support student performance and well-being.

Vocational interests and the profession of rehabilitation education

Holland's RIASEC model of vocational interest

Vocational interests represent key personality characteristics that highlight individual differences in motivation, objectives, and personal ambitions (Stoll et al., 2017). Using the framework of vocational interests by Holland (1959, 1997) three different postulations exist: (1) the RIASEC model describing six domains of vocational interest, (2) the calculus hypothesis, and (3) the congruence assumption.

- (1) The RIASEC model distinguishes six vocational interest domains: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C). These domains represent a combination of interests that are reflected in activities, beliefs, skills, values, and traits. Both individual preferences and, more broadly, characteristics of a person's work environment are described here (Chu et al., 2022). To describe the six domains more precisely (Chu et al., 2022; Roemer et al., 2023): persons with Realistic (R) interests prefer physical work involving their hands, objects, or tools (e.g., woodworking, mechanics). Those with Investigative (I) interests prefer work involving scholarly, research, or scientific activities in which thinking about problems is central. Artistic (A) interests focus on creativity and self-expression (e.g., painting a portrait, dancing). People with high Social (S) interests prefer tasks and occupations involving helping, nurturing, serving, or teaching others (e.g., nursing, elementary school teaching). Those with Enterprising (E) interests prefer business-related or influence-oriented activities, such as selling, managing, and leading. Finally, persons with Conventional (C) interests prefer orderly and systematic work (e.g., tracking shipping records, accounting).
- (2) The calculus hypothesis assumes that the six RIASEC domains are arranged in a hexagonal (or circular) structure. This structure is based on the idea that

adjacent interest domains (e.g., realistic and investigative) are more closely related than non-adjacent domains (e.g., realistic and artistic). Opposite domains are considered the least related (e.g., realistic and social; Roemer et al., 2023). However, there is an ongoing debate about whether the hexagonal structure should be retained or replaced by a circumplex, polygonal, or elliptical structure (Leon et al., 2018).

- (3) Within the framework of Person-Environment (P-E) Fit theory (Edwards, 1991; Edwards and Shipp, 2007), the concept of congruence in vocational interests has been further developed (Hoff et al., 2020; Su et al., 2015). Congruence refers to the alignment between an individual's personal interest type and the characteristics of a professional setting, such as an artistic personality fitting well within an artistic work environment (Chu et al., 2022).

Empirical findings support the aforementioned assumptions, as outlined in the following sentences. Evidence suggests that interest congruence predicts (academic) performance more accurately than interest scores alone (Nye et al., 2017). The higher the congruence of interest between an individual's interests and the vocational environment, the more positive the association with job satisfaction and life satisfaction, whereas congruence is negatively correlated with turnover intention (Hayes and Stazyk, 2019; Tsabari et al., 2005; Xu and Li, 2020). Researchers have also noted the complex relationship between high congruence and academic success, including positive associations with academic achievement, persistence in the study program, and satisfaction with the study program (de Vries et al., 2024).

A nomological network provides insights into the relationships between other concepts of individual differences and vocational interests (Armstrong et al., 2008; Roemer et al., 2023), like the Five-Factor Model of personality, also known as Big Five personality traits, that is an established psychological theory (Costa and McCrae, 2008) and important in higher education (Wild and Alvarez, 2020). It describes personality through five broad dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism. Following Angelini (2023) openness comes with curiosity and interest in new ideas, conscientiousness with being organized and responsible, and extraversion with being energetic and socially outgoing. The same research defines agreeableness as being kind, cooperative, and caring toward others. Neuroticism is defined as the tendency to experience negative emotions such as anxiety, sadness, and emotional instability (Angelini, 2023). These traits capture the main ways people differ in how they think, feel, and act. The model provides a clear, reliable framework for studying personality across cultures and contexts. Our manuscript builds on this theoretical foundation to explain individual differences and behavior in the study context. Analyses of associations between vocational interests and the Big Five personality traits have a long history (van der Linden et al., 2022). According to a meta-analysis by Mount et al. (2005), four correlations bigger correlations between personality traits and vocational interests were identified: openness to experience with artistic interests, extraversion with enterprising interests, extraversion with social

interests, and openness to experience with investigative interests. A further meta-analysis by Larson et al. (2002) revealed similar findings. More recent research confirms these associations and provides additional evidence for relationships between agreeableness and social interests (Roemer et al., 2023; van der Linden et al., 2022). A meta-analysis by Hurtado Rúa et al. (2019) found that extraversion is related to the social interests and enterprising, and that openness is related to the arts dimension.

Gender-specific differences are also evident in vocational interests. According to a meta-analysis conducted by Su et al. (2009), men exhibited comparatively stronger realistic and investigative vocational interests. In contrast, women show higher levels of artistic, social, and conventional interests.

Professions similar to rehabilitation education, such as special education teachers or social workers, show high levels of social and artistic vocational interests (German Federal Employment Agency, n.d.). Putz (2011) confirms these results in his empirical study, highlighting strong vocational interests in the social domain among teachers. Medical students, by contrast, score highly in the investigative and social domains (Duffy et al., 2009). However, specific findings for the profession of rehabilitation education are still lacking.

Profession of rehabilitation education

The origins of rehabilitation education can be traced to efforts to combat epidemics and to wartime contexts, such as in the U.S. between World War I and World War II, where the focus lay on ensuring the survival of wounded individuals and restoring injured soldiers to functional life (European Physical and Rehabilitation Medicine Bodies Alliance, 2018a). In a more educational context, its beginnings can be linked to the early vocational rehabilitation laws of 1918, most known as the *Smith-Sears Act*, which laid the foundation for supporting individuals with disabilities in regaining independence and re-entering the workforce (Thurber, 1946). Key figures such as Howard Rusk pioneered comprehensive rehabilitation programs that integrated physical, psychological, and social aspects of recovery (Rusk, 1953). The formalization of the specialty took place in the 1940s and 1950s, when professional societies and certification boards were established to promote training, research, and clinical standards (Turk et al., 2013).

The rehabilitation education profession is crucial because it supports individuals with disabilities or functional impairments in maximizing their independence and quality of life. In addition to physical recovery, rehabilitation also focuses on psychological adaptation, skill acquisition, and social reintegration (Barria et al., 2025; European Physical and Rehabilitation Medicine Bodies Alliance, 2018a). According to Beamish et al. (2024), professionals working in (medical) rehabilitation should possess the following four core competences: (a) evidence-based clinical practice knowledge and skills; (b) culturally competent communication and collaboration; (c) professional reasoning and behaviors; and (d) interprofessional collaboration. These competencies enable professionals in the field to address the multidimensional needs of patients.

In Germany, students in rehabilitation education are trained through bachelor's degree programs at four universities. Related master's programs and specializations in rehabilitation science are also offered at several other universities. The various bachelor's programs take different perspectives on rehabilitation education (Stöhr et al., 2025). In addition to the classic, medically oriented training, some programs adopt a distinctly educational and "non-medical" perspective on vocational and social rehabilitation. For example, one of the largest university for training students in rehabilitation education in Germany, TU Dortmund University, describes its degree program in contrast to medical rehabilitation as follows:

"Rehabilitation education deals with social rehabilitation and pedagogy in the context of the professional, social and digital participation of people with disabilities on an interdisciplinary basis. [Students] will learn how to identify the needs of people with disabilities and design living spaces tailored to their skills and the general conditions. [They] will also work to raise society's awareness of issues such as diversity, inclusion and participation. [...] The general principles teach specialist knowledge and methods in the fields of education, professional ethics and communication. [Students] will also deal with selected content from psychology and diagnostics. Sociology and social law also play a role [...]. [They] will also learn the most important basics of accessibility, aids and assistive technologies. [...]" (TU Dortmund University, 2025).

Professionals in rehabilitation education in the above-mentioned sense work in a wide range of settings in medical and special education systems (European Physical and Rehabilitation Medicine Bodies Alliance, 2018b, c). For example, professional rehabilitation educators work in child and youth welfare services, residential facilities, vocational rehabilitation centers, counseling and coordination services, as well as in research and teaching (German Federal Employment Agency, 2025). Their work often overlaps with that of other professions, such as social workers (Turk et al., 2013). Due to the broad range of career opportunities available to graduates of rehabilitation education programs, the programs themselves are quite broad in scope. Students who do not have a clear career path in mind, or whose professional interests do not align with the programs content, expectations, or self-regulation demands, are more likely to drop out and less likely to succeed (Wild and Grassinger, 2023).

The present study

The current study integrates the RIASEC framework (Holland, 1997) with a person-oriented approach (Bergman and Lundh, 2015) to map the vocational interest landscape of rehabilitation education students in Germany. While previous research has identified general interest patterns in related fields like special education (Putz, 2011), the interdisciplinary nature of rehabilitation education—blending medical, pedagogical, and socio-legal components (TU Dortmund University, 2025)—suggests that a monolithic "social" profile may not be suffice to

describe the student body. By employing cluster analysis, we aim to identify latent subgroups that reflect the diverse professional trajectories (e.g., counseling, research, management) inherent in the field. The following research questions (RQ) are addressed:

In RQ 1, we elaborate different interest profiles. Following the "calculus hypothesis" (Holland, 1997), we expect that students in a help-oriented discipline will gravitate toward the social domain. However, due to the increasing demand for evidence-based practice and professional management in rehabilitation (Beamish et al., 2024), we anticipate the emergence of "hybrid" profiles.

In RQ 2, we validate profiles from RQ1 by predictive factors. We draw on the Big Five personality traits as well as demographic and structural factors. We examine their relationship with stable personality dispositions. According to the Top-Down Model of Personality and Interests (Alves et al., 2024; Mount et al., 2005), Big Five traits serve as the developmental scaffold for vocational interests. Based on meta-analytic evidence that suggests openness as a core precursor for investigative and artistic interests, while agreeableness and extraversion underpin the social domain (Hurtado Rúa et al., 2019; Roemer et al., 2023), we await that high levels of openness will predict membership in clusters with strong investigative or artistic leanings. Furthermore, we await that high agreeableness will be a significant predictor for membership in the primary social-oriented clusters. In the analyzes of demographic and structural factors, we assume that vocational interests are relatively stable (Etzel and Nagy, 2021) and the inclusion of age and degree type (bachelor vs. master) serves as a necessary control for professional socialization. Furthermore, the university location is included as a predictor to account for the distinct regional profiles and curricular focuses of German universities (German Science and Humanities Council, 2010), which may attract different student typologies (e.g., more research-oriented vs. practice-oriented programs).

By aligning individual dispositions, like by Big Five dimension, and structural contexts, like university location, we are able to give different perspective on factors predicting the identified interest clusters. So, we give first hints to shed light within the complex field of rehabilitation education.

Methods

Participants and design

This study uses data from the project "Aptitudes and interests of students in rehabilitation education". The aims of this research project are to investigate how success factors and study conditions are associated in this academic field. The project gives the theoretical and empirical framework for this study in rehabilitation education. The study population consists of students enrolled in the rehabilitation education program, who were invited to participate voluntarily during the summer term of 2025. A cross-sectional research design was applied, using a convenience sampling strategy. Data were collected through an online survey. All enrolled students in the study program were invited to participate via email lists and learning platforms. In addition, time was provided during teaching sessions for

students to complete the survey. The study received ethical approval from the Ethics Committee of TU Dortmund University (approval number: GEWK_2025-14). All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards (World Medical Association, 2013).

The final dataset comprises $N = 140$ students (86% female; age $M = 24.19$ years; $SD = 4.92$). Data were gathered across four universities in Germany. The participant cohort consists predominantly of students enrolled in the bachelor's degree programs (71%), with the remaining 29% pursuing a master's degree. Detailed demographic information is provided in Table 1 of the Supplementary Material. It should be noted that only a small number of participants attended certain locations; therefore, locations with fewer than 30 participants were aggregated into the "Other" category.

Measures

McDonald's omega coefficient was applied as an indicator of measurement reliability (McDonald, 1999), with values of $\omega \geq 0.70$ considered satisfactory (Viladrich et al., 2017). All psychometric instruments consist of items rated on a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). A detailed summary is provided in Table 2 of the Supplementary Material.

Vocational interests

The "German O*NET Interest Profiler Short Form" developed by Roemer et al. (2023) was used to assess vocational interests. Drawing on Holland's (1997) theoretical framework, these interests are conceptualized across the six RIASEC dimensions. Reliability analyses indicate satisfactory internal consistency for the dimensions: Realistic (R; $\omega = .85$; 10 items; example: "Lay brick or tile"), Investigative (I; $\omega = .90$; 10 items; example: "Develop a new medicine"), Artistic (A; $\omega = .86$; 10 items; example: "Compose or arrange music"), Social (S; $\omega = .78$; 10 items; example: "Help conduct a group therapy session"), Enterprising (E; $\omega = .83$; 10 items; example: "Start your own business"), and Conventional (C; $\omega = .83$; 10 items; example: "Keep inventory records").

Big five inventory

The Big Five personality traits were assessed using the instrument developed by Rammstedt and John (2005). Data were collected for openness to experience ($\omega = .80$; nine items; example item: "Clever; thinks a lot."), conscientiousness ($\omega = .87$; nine items; example item: "Does things carefully and completely."), extraversion ($\omega = .86$; eight items; example item: "Talks a lot."), agreeableness ($\omega = .79$; ten items; example item: "Kind and considerate to almost everyone."), and neuroticism ($\omega = .78$; eight items; example item: "Gets nervous easily."). Within the openness to experience scale, the original item "Likes work that is the same every time" was excluded due to a

low item-total correlation ($r_{it} = -.01$). The internal consistency of the scales was considered satisfactory.

Demography

We collected four demographic variables: gender, university location, age, and study program. Table 1 in the Supplementary Material shows a detailed overview. Most participants were female (86%), while only 10% were male and 4% identified as diverse. Due to the small and uneven group sizes, a meaningful gender-based analysis was not possible with a total sample of 140 participants. Most students were in a bachelor's program (71%), and 29% were in a master's program. More than half of the participants studied at TU Dortmund University (54%), about one-third at Humboldt-Universität to Berlin (29%), while other university locations were grouped into "other" because of low numbers. Age in years ($M = 24.19$; $SD = 4.92$) was also recorded.

Data analyses and missing values

The analyses were conducted using R Core Team (2023) version 4.3.2. When no R-package is specified, IBM SPSS Statistics (version 31; IBM Corp, 2023) was used. We consider $p < .05$ as statistically significant (two-tailed).

In a preliminary analysis, vocational interests and their associations with age, university location, Big Five personality traits, and study program were examined. Correlations according to Spearman (r_s) were interpreted as small for values between $r = 0.10$ – 0.29 , medium for values between $r = 0.30$ and $r = 0.49$, and large for values of $r \geq 0.50$ (Cohen, 1988). The effect size Cohen's f was considered as small between $f = 0.10$ – 0.24 , medium for effects between $f = 0.25$ and $f = 0.39$, and large for values of $f \geq 0.40$ (Cohen, 1988). Normality was assessed based on skewness and kurtosis values, with values outside the -1 to $+1$ range considered indicative of potential issues (Hair et al., 2014; Urban and Mayerl, 2018). In further analyses, nonparametric statistics were applied, including the Mann-Whitney U -test and Kruskal-Wallis-test, with pairwise comparisons performed using Dunn-Bonferroni *post hoc* test (Warne, 2020).

The analysis of RQ 1 was based on a cluster analysis (Everitt et al., 2011). Prior to the final cluster analysis, four outliers were identified and excluded using the Nearest Neighbor and Single Linkage cluster methods (Wiedenbeck and Züll, 2010). The final cluster analysis included the determination of squared Euclidean distance and the Ward's method (Everitt et al., 2011). The number of clusters was determined by inspecting the dendrogram and evaluating the cluster evaluation coefficients of the Davies-Bouldin-Index (lower values indicate a better cluster solution), the Ratkowsky-Index (higher values indicate a better cluster solution), and the Silhouette-Index (higher values indicate a better cluster solution; Davies and Bouldin, 1979; Everitt et al., 2011; Ratkowsky and Lance, 1978; Ros et al., 2023). These coefficients were estimated using the R package "NbClust" (Charrad et al., 2014) version 3.0.1.

RQ 2 was addressed using multinomial logistic regression. The purpose of these analyses was to identify factors associated with the likelihood of cluster membership. In multinomial logistic regression analyses, odds ratios [OR ; $\text{Exp}(\beta)$] were reported. An

OR greater than 1 indicated a positive association, whereas an OR below 1 indicated a negative association relative to the reference category (Hair et al., 2014). Parallel, we estimated the Average Marginal Effect (AME) in our multinomial logistic regression (Mood, 2010). An AME represents the average change in the probability or value of the outcome variable across all observations in the sample when a specific independent variable increases by one unit. Specifically, values greater than 0 indicate a positive relationship where the outcome likely increases, while values less than 0 represent a negative effect. AME is estimated by R package “nnet” (Venables and Ripley, 2002) version 7.3.20 and R package “marginaleffects” (Arel-Bundock et al., 2024) version 0.25.1. Model fit was evaluated using pseudo R^2 measures, including McFadden, Cox and Snell, and Nagelkerke (Denham, 2017).

In the sample of 140 participants, some missing values were present. Item non-response ranged from 0 percent to 0.7 percent. In 136 cases (97.86 percent of the sample) and 99.97 percent of the measures, no missing values occurred. Missing values were exclusively present in the variable gender. Littles’ (1988) test for Missing Completely at Random (MCAR) was non-significant ($\chi^2 = 333.988$, $df = 322$, $p = .311$) indicating that the data can be considered MCAR. In subsequent analyses, missing data were imputed using multiple imputation by chained equations using the R package “mice” version 3.16.0 with 100 imputations (Lee and Shi, 2021; van Buuren and Groothuis-Oudshoorn, 2011). The imputation model included all variables present in the analysis as predictors to preserve the associations between them, specifically employing polytomous regression for estimating the categorical gender variable.

Results

Preliminary analysis

Table 1 presents the descriptive statistics and correlations (r_s) of the vocational interest scales and Big Five personality. Students in rehabilitation education showed the highest vocational interest in the social domain ($M = 3.57$; $Md = 3.70$; $SD = 0.70$) and the lowest interest in the realistic domain ($M = 1.68$; $Md = 1.50$; $SD = 0.66$). The distributions for the realistic ($kurtosis = 5.01$; $skewness = 1.81$), social ($kurtosis = 2.09$; $skewness = -1.18$), enterprising ($kurtosis = 1.24$; $skewness = 0.92$), and conventional domains ($kurtosis = 4.92$; $skewness = 1.73$) as well as the Big Five personality trait agreeableness ($kurtosis = 2.78$; $skewness = -1.14$) are considered problematic, as they fall beyond the -1 to $+1$ range. Since the assumption of normality could not be reasonably met for these variables, non-parametric methods are applied as the analytical approach. The correlations r indicate that adjacent interest domains (e.g., enterprising–conventional: $r_s = .44$; realistic–investigative: $r_s = .59$) correlate more strongly than opposite domains (realistic–social: $r_s = .23$; investigative–enterprising: $r_s = .41$). Strongest correlations between vocational interests and the Big Five personality traits, show a medium effect size and are between artistic–openness to experience ($r_s = .48$) and social–agreeableness ($r_s = .31$). The correlations between the Big Five personality traits were at most moderate, see highest correlation

between extraversion and neuroticism ($r_s = -.34$). Therefore, multicollinearity is not expected to be a problem in the regression analyses. According to Urban and Mayerl (2018), such issues only occur when correlations reach or exceed $|r| = .80$.

Students’ vocational interests were compared between university locations; see Table 3 of the Supplementary Material. Kruskal–Wallis-tests revealed a significant difference for interests in the enterprising domain [$H(2) = 7.522$, $p = .023$; $f = .22$]. Subsequent *post hoc* pairwise comparisons using the Dunn test indicated that students from TU Dortmund University ($Md = 2.3$) scored higher than students from Humboldt University Berlin ($Md = 1.7$), $z = -2.56$; $p = .032$; $r = .24$.

Vocational interests and study programs were also compared. Mann–Whitney U -tests showed no significant results (see Table 4 of the Supplementary Material). The only exception was in conventional interest, where students in the master’s program ($Md = 1.80$) scored higher than those in the bachelor’s program ($Md = 1.55$), $U = 1,531.00$, $z = -2.171$, $p = .030$, $r = .18$.

Research question 1

To address RQ 1 concerning inter-individual differences in vocational interests, the appropriate number of interest clusters was determined using a cluster analysis. Table 2 summarizes the estimated indices for the respective cluster solutions. The Davies–Bouldin-Index and the Ratkowsky-Index both suggest a three-class solution, whereas the Silhouette-Index indicates a two-class solution. Considering the smallest group frequency, a three-class solution is also justifiable, as the smallest cluster still comprises 29 cases. The dendrogram supports a three-cluster solution (see Figure 1), with two larger groups clearly visible, yet a closer inspection justifies a third, smaller cluster. A four-cluster interpretation appears forced and less meaningful, as the fourth cluster would contain too few cases. Therefore, a three cluster solution provides a balanced and coherent structure. We subsequently focused on with three cluster solution - see the cut line in Figure 1.

Based on the results shown in Figure 2, the z -scores reveal distinct patterns of vocational orientation across the following three groups: the Pragmatic-Analytical group, the Creative-Inspired group, and the Lower-Interest group. The Pragmatic-Analytical group ($n = 29$) demonstrates strong positive deviations in the realistic ($z = 1.44$) and investigative ($z = 1.05$) domains, with moderately elevated conventional interests ($z = 0.53$). The Creative-Inspired group ($n = 53$) shows moderate positive deviations in the artistic ($z = 0.56$) and enterprising ($z = 0.45$) domains. In contrast, the Lower-Interest group ($n = 54$) exhibits consistent negative z -scores across all six dimensions, indicating generally lower engagement or vocational orientation. These patterns underscore the group differentiation in vocational interests.

The Lower-Interest Group is used as the reference category in the multinomial logistic regression in analyzing RQ 2 because, both theoretically and empirically, it represents the lowest overall level of vocational interest across all RIASEC dimensions. Theoretically, this group reflects a baseline profile with consistently negative z -scores in realistic, investigative, artistic, social, enterprising, and conventional domains, making it a

TABLE 1 Descriptive statistics, internal consistency estimates, and intercorrelations according to spearman (rs) between vocational interests and Big five personality traits.

Study variables	R	I	A	S	E	C	O	Co	Ex	Ag	N
Realistic (R)	.85	.53***	.19*	.23**	.32***	.59***	.01	-.08	-.01	-.15	-.11
Investigative (I)		.90	.29***	.25**	.41***	.47***	.06	-.09	-.06	-.13	-.04
Artistic (A)			.86	.30***	.25**	.23**	.48***	-.12	-.07	.11	-.07
Social (S)				.78	.28***	.23**	.15	.06	.15	.31***	-.18*
Enterprising (E)					.83	.44***	.10	-.02	.16	-.14	-.09
Conventional (C)						.83	.05	.02	-.05	-.09	-.08
Openness to experience (O)							.80	.03	.16*	.17	-.04
Conscientiousness (Co)								.87	.07	.28***	-.24**
Extraversion (Ex)									.86	.14	-.34***
Agreeableness (Ag)										.79	-.27**
Neuroticism (N)											.78
<i>M</i>	1.68	2.38	2.62	3.57	2.12	1.73	3.72	3.60	3.43	3.89	3.03
<i>Md</i>	1.50	2.30	2.60	3.70	2.00	1.70	3.67	3.67	3.50	4.00	3.00
<i>SD</i>	0.66	0.93	0.89	0.70	0.74	0.65	0.67	0.75	0.76	0.62	0.68
<i>Skewness</i>	1.81	0.52	0.10	-1.18	0.92	1.73	-0.14	-0.48	-0.17	-1.14	0.13
<i>Kurtosis</i>	5.01	-0.31	-0.76	2.09	1.24	4.92	-0.45	-0.45	-0.70	2.78	-0.22

Sample size is *N* = 140. Items were answered on a scale from 1 (= strongly disagree) to 5 (= strongly agree). In diagonal is ω = reliability of McDonald's omega (McDonald, 1999). r_s , Spearman's rank correlation coefficient (ρ); *M*, mean; *Md*, median; *SD*, standard deviation.

**p* < .05.
 ***p* < .01.
 ****p* < .001.

TABLE 2 Cluster evaluation metrics.

Cluster solutions	Metrics			
	Davies-Bouldin-index	Ratkowsky-index	Silhouette index	Smallest group frequency
2 cluster solutions	1.673	0.317	0.232	54
3 cluster solutions	1.591	0.318	0.170	29
4 cluster solutions	1.604	0.296	0.159	13
5 cluster solutions	1.711	0.283	0.160	13

Sample size is *N* = 136.

conceptually meaningful comparison category for more differentiated and interest-driven profiles. Empirically, its uniformly low z-score values and sample size of 54 persons provide a stable and neutral benchmark against which the Pragmatic-Analytical and Creative-Inspired groups can be clearly contrasted in terms of elevated and domain-specific interest patterns.

Table 3 describes characteristics of the three analysed cluster groups. First, the Pragmatic-Analytical group is distinguished by the highest interest in investigative activities (*M* = 3.30; *SD* = 0.73), suggesting a stronger preference for intellectual and scientific tasks compared to the other clusters. Second, the Creative-Inspired group shows a markedly higher artistic interest (*M* = 3.07; *SD* = 0.80) than both the Pragmatic-Analytical (*M* = 2.54; *SD* = 0.74) and the Lower-Interest (*M* = 2.13; *SD* = 0.77) groups. Third, the Lower-Interest group is characterized by consistently lower scores across nearly all vocational interest dimensions, particularly in the realistic

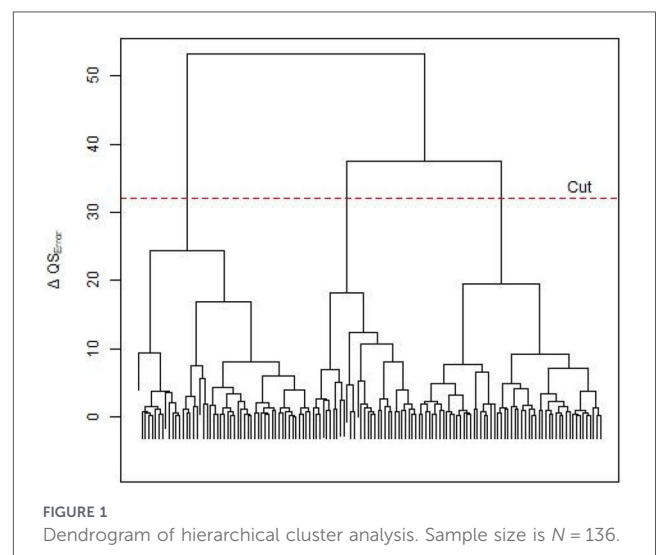


FIGURE 1 Dendrogram of hierarchical cluster analysis. Sample size is *N* = 136.

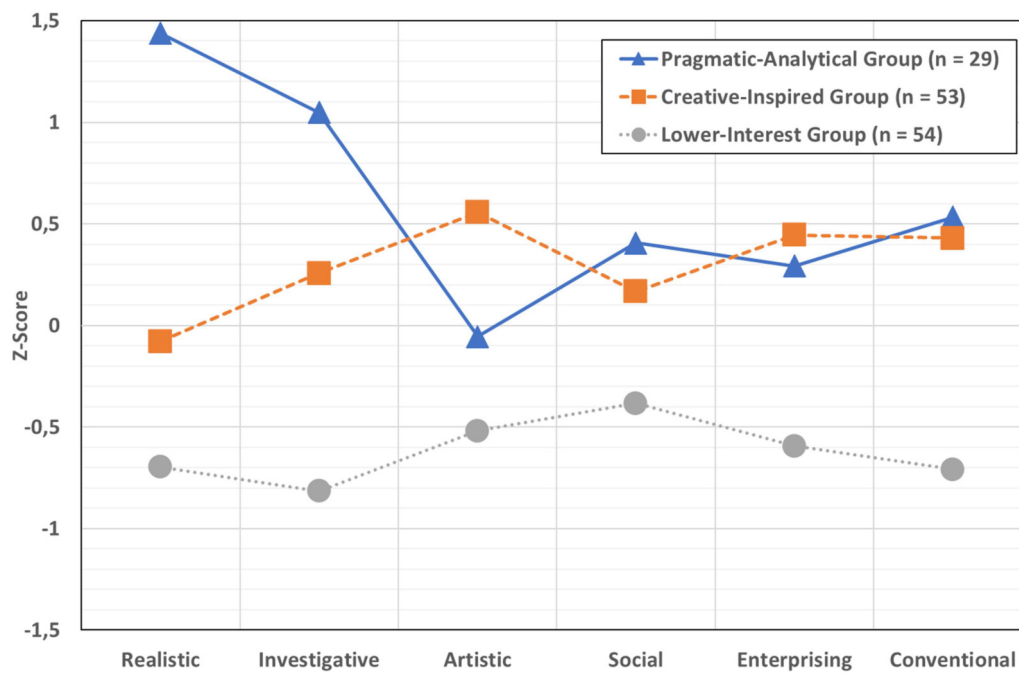


FIGURE 2
Cluster analysis with three group solution. Sample size is $N = 136$.

($M = 1.24$; $SD = 0.27$) and conventional ($M = 1.29$; $SD = 0.30$) domains. Fourth, regarding personality traits, the Creative-Inspired group exhibits the highest levels of openness to experience ($M = 3.87$; $SD = 0.69$), which aligns with their elevated artistic interests. Finally, a striking demographic difference is observed in gender distribution; while all groups are predominantly female, the Lower-Interest group is almost exclusively composed of women (96%), whereas the Pragmatic-Analytical group contains a notably higher proportion of male participants (21%). The three groups can be seen in detail:

Lower-interest group

Students in this group exhibit weak endorsement across all vocational interest domains. Rather than interpreting this profile solely as disengagement, it can also be understood through the lens of developmental vocational psychology as a phase of ongoing interest crystallization (Hoff et al., 2020). This interpretation is supported by research suggesting that early-stage university students may display diffuse or weakly differentiated interest structures, particularly in broad and interdisciplinary programs. Accordingly, this group may represent students at risk of poor person–environment fit, which has been consistently linked to lower persistence and satisfaction (Nye et al., 2017; Xu and Li, 2020).

Creative-Inspired group

Students belonging to this group are characterized by strong affinity for artistic interests, combined with elevated enterprising tendencies. This combination is theoretically meaningful, as recent extensions of the RIASEC model emphasize the increasing relevance of hybrid profiles that integrate creativity with agency

and leadership in modern professions (Deng et al., 2007; Williamson Fletcher, 2022). Their relatively balanced profile across investigative and social orientations indicates versatility in working with both ideas and people. Such profiles may be particularly well suited for emerging roles in rehabilitation that require innovation in inclusive practices and digital participation contexts.

Pragmatic-analytical group

Students belonging to this group exhibit a strong orientation toward realistic and investigative interests. This pattern corresponds closely to evidence-based and diagnostically oriented aspects of rehabilitation practice, thereby reflecting a subgroup that may be particularly aligned with research-intensive or assessment-driven career paths within the field. Moderate alignment with social and conventional interests suggests functional adaptability, which has been identified as a key competence in interprofessional rehabilitation settings (Beamish et al., 2024).

Research question 2

To address RQ 2, a multinomial logistic regression was conducted to examine the predictive value of individual characteristics for group membership across the three identified clusters: Lower-Interest, Creative-Inspired, and Pragmatic-Analytical. As shown in Table 4, the overall model fit was relatively weak, with goodness-of-fit indices indicating modest explanatory power (*Cox and Snell* $R^2 = .126$; *Nagelkerke* $R^2 = .143$; *McFadden* $R^2 = .063$). Demographic variables—namely age, university location, and type of study degree—did not

TABLE 3 Description of the cluster group characteristics.

Study variables	Pragmatic-analytical group (n = 29)		Creative-Inspired Group (n = 53)		Lower-interest group (n = 54)	
	M/Proportion	SD	M/Proportion	SD	M/Proportion	SD
Vocational Interests						
Realistic	2.37	0.42	1.57	0.30	1.24	0.27
Investigative	3.30	0.73	2.58	0.67	1.62	0.52
Artistic	2.54	0.74	3.07	0.80	2.13	0.77
Social	3.86	0.56	3.71	0.48	3.35	0.76
Enterprising	2.26	0.72	2.36	0.64	1.67	0.45
Conventional	1.93	0.44	1.88	0.51	1.29	0.30
Big Five Inventory						
Openness to experience	3.69	0.70	3.87	0.69	3.59	0.62
Conscientiousness	3.54	0.67	3.67	0.78	3.62	0.74
Extraversion	3.32	0.84	3.54	0.66	3.40	0.75
Agreeableness	3.76	0.71	3.95	0.55	3.98	0.50
Neuroticism	3.00	0.74	2.89	0.52	3.16	0.76
Age	24.50	5.65	24.04	4.49	24.18	5.04
Gender						
Female	76%		85%		96%	
Male	21%		9%		4%	
Diverse	3%		6%			
Study Program						
Bachelor	76%		74%		70%	
Master	24%		26%		30%	
University						
TU Dortmund University	55%		55%		55%	
Humboldt-Universität zu Berlin	28%		26%		30%	
Other	17%		19%		15%	

significantly predict membership in either the Pragmatic-Analytical or the Creative-Inspired group relative to the Lower-Interest group (reference category). In contrast, personality traits from the Big Five model emerged as significant predictors. Openness to experience positively and significantly increased the likelihood of membership in the Creative-Inspired group [$\text{Exp}(\beta) = 2.217$; $\text{AME} = 0.141$; $p = .022$], whereas neuroticism had a negative effect [$\text{Exp}(\beta) = 0.451$; $\text{AME} = -0.116$; $p = .025$]. Additionally, agreeableness was negatively and significantly associated with membership in the Pragmatic-Analytical group [$\text{Exp}(\beta) = 0.389$; $\text{AME} = -0.100$; $p = .044$].

Discussion

Empirical research on students in rehabilitation education is sparse. Against this background, the present findings contribute to closing a clearly identifiable research gap by linking person-oriented interest profiles with dispositional personality

frameworks in an interdisciplinary study context, thereby responding directly to recent calls for integrative models in vocational psychology (Hoff et al., 2024; Spurk et al., 2020). Therefore, we examined interindividual differences in vocational interests (Holland, 1997) and factors predicting the membership in the identified interest groups. This approach is justified by the established association between academic success and satisfaction (de Vries et al., 2024; Wei, 2024). The results indicate that three distinct vocational interests' groups emerge among students in rehabilitation education, and that group membership is partially predicted by Big Five personality traits.

Preliminary analyses show that students in rehabilitation education exhibit the highest vocational interests in the social and artistic domains. Importantly, this pattern is not merely descriptive but aligns with the competence requirements of rehabilitation professions, which combine interpersonal support with adaptive and creative problem-solving (Barria et al., 2025; Beamish et al., 2024). This finding supports the assumptions by the German Federal Employment Agency (n.d.) and Putz

TABLE 4 Multinomial logistic regression predicting membership in the three vocational interest clusters.

Study variables	Coefficients					
	Pragmatic-analytical group			Creative-inspired group		
	Exp (β)	AME	p-value	Exp (β)	AME	p-value
Openness to experience	1.512	0.001	.298	2.217	0.141	.022
Conscientiousness	1.034	-0.002	.926	1.101	0.018	.754
Extraversion	0.832	-0.037	.613	1.093	0.035	.777
Agreeableness	0.389	-0.100	.044	0.538	-0.058	.138
Neuroticism	0.487	-0.050	.076	0.451	-0.116	.025
Master (Ref. Bachelor)	0.319	-0.105	.260	0.424	-0.101	.275
Age	1.007	0.003	.900	0.973	-0.007	.573
Location Others	3.176	0.085	.318	3.044	0.130	.224
Location HU zu Berlin (Ref. TU Dortmund University)	1.617	0.024	.453	1.833	0.091	.267
Cox und Snell R^2			.126			
Nagelkerke R^2			.143			
McFadden R^2			.063			

Sample size is $N = 136$. Reference group is Lower-Interest Group. Exp (β), odds ratio; AME, average marginal effect; Ref., reference group.

(2011). Further analyses between Big Five and RIASEC interests, show largest associations between openness and arts, that is similar to current research (Hurtado Rúa et al., 2019). Thus, the observed correlation pattern can be interpreted as an internal validation of the measurement model, consistent with analytic evidence on the nomological network of interests and personality (Roemer et al., 2023; van der Linden et al., 2022). The results provide initial evidence for the validity of our research given the convergence with findings from comparable studies.

The analysis of RQ 1 identified three distinct vocational interest types among rehabilitation education students. Crucially, this typological differentiation extends prior variable-centered findings by demonstrating that the student population cannot be adequately described by a single dominant “social” profile, but rather reflects heterogeneous and partially hybrid configurations of interests. The largest group is the Lower-Interest Group, followed by the Creative-Inspired Group. The smallest interest group is the Pragmatic-Analytical Group. The three groups can be summarized as follows: The Lower-Interest Group shows consistently low scores in all RIASEC dimensions, that indicating a generally weak differentiated vocational interest structure. The Creative-Inspired Group is characterized by higher scores in artistic and enterprising interests. This reflects a creative, proactive, and versatile vocational interest orientation. The Pragmatic-Analytical Group has strong realistic and investigative interests. This represents a more practically oriented and analytically driven vocational profile.

With regard to RQ 2, the findings indicate that only the Big Five personality traits show a significant association with the interest group formations. This result reinforces the assumptions of the Top-Down Model of Personality and Interests, according to which broad personality traits act as distal predictors of more specific vocational preferences (Alves et al., 2024; Mount et al., 2005).

Specifically, openness to experience, agreeableness, and — somewhat unexpectedly— neuroticism emerged as relevant predictors. While the relationship of openness and agreeableness with students in rehabilitation education’s interests were anticipated (Mount et al., 2005; van der Linden et al., 2022), the role of neuroticism requires further explanation. The negative association between neuroticism and membership in differentiated interest profiles suggests that emotional instability may inhibit the formation of clear vocational preferences, a mechanism that has been discussed in recent longitudinal research (Vukasović Hlupić et al., 2022). Extraversion, in contrast, appears unrelated to group membership. This finding nuances prior meta-analytic results by indicating that extraversion may be less relevant in contexts where social interaction is a baseline requirement across all subgroups, thereby reducing variance (Hurtado Rúa et al., 2019). The observed negative association with agreeableness may be explained by certain behavioral tendencies linked to this personality trait. More specifically, highly agreeable individuals may avoid assertive or leadership-oriented roles, which could reduce their likelihood of belonging to profiles that combine social engagement with enterprising characteristics. This interpretation is consistent with recent research on the ambivalent role of agreeableness in performance-oriented contexts (Espinoza et al., 2023).

Furthermore, the findings indicate that the university location does not play a measurable role. This suggests that dispositional factors outweigh institutional influences in shaping vocational interests, at least at the level of broad RIASEC dimensions. Similarly, neither age nor study program emerged as predicting factors. Taken together, these findings support the assumption of relative stability of vocational interests while also indicating that differentiation occurs more strongly at the intra-individual than at the contextual level (Etzel and Nagy, 2021; Hoff et al., 2020).

From a theoretical perspective, these findings can be meaningfully integrated into the proposed vocational interest

framework. First, the observed correlation structure supports Holland's calculus hypothesis, thereby confirming the structural validity of the RIASEC model within an interdisciplinary German sample. Second, the identification of hybrid clusters provides empirical support for ongoing debates advocating extensions of the traditional hexagonal model toward more flexible and multidimensional representations (Hoff et al., 2024; Leon et al., 2018).

Results could be interpreted based on the ideas by Prediger (1982). This framework about vocational interests can be described along two core dimensions: People vs. Things and Data vs. Ideas, which underlie Holland's RIASEC types and are currently discussed (Etzel et al., 2023). RIASEC can be mapped in Prediger's (1982) dimensions in the way that realistic interests correspond primarily to things-, investigative interests to things- and ideas-, artistic interests to ideas- and people-, social interests to people-, enterprising interests to people- combined with data-, and conventional interests mainly to data- and things-oriented tasks (Wiegand and Bruno, 2018). Applying this to our study, we can say, that the Pragmatic Analytical Group scores high on realistic and investigative interests, indicating a strong orientation toward things- and ideas-tasks rather than toward people- or data-oriented tasks. The Creative Inspired Group shows higher scores on artistic and enterprising interests, placing them in the people-oriented tasks dimension with slight tendencies towards data-oriented and ideas-oriented dimension. Finally, the Lower Interest Group has below average scores on all six RIASEC dimensions, indicating a relatively low overall vocational interest profile with no strong tendency to one core dimension in the framework of Prediger (1982).

The present study is subject to several limitations that warrant consideration. First, the generalizability of the findings is limited due to the relatively small sample size, the constrained statistical power, and the fact that data collection was confined to Germany. Furthermore, the use of convenience sampling, combined with demographic imbalances within the dataset, poses additional challenges (Khan et al., 2024; Wang et al., 2021). Such imbalances can bias statistical modeling, as algorithms may disproportionately favor majority groups, thereby reducing predictive accuracy for minority subgroups (Gupta et al., 2022). Potential approaches to mitigate these issues include resampling strategies, case weighting, or more systematic and targeted data collection procedures (Gabler and Ganninger, 2010). Another methodological concern arises from the cluster analyses, which produced inconsistent results. Divergent optimal solutions indicated by the Davies–Bouldin Index, the Ratkowsky Index, and the Silhouette Index highlight the ambiguity of cluster stability and interpretation. Significant results of the predictor agreeableness in multinomial regression analysis should be interpreted with caution, because the assumption of normal distribution is questionable. Specifically, the sample size of $N = 136$ may be considered relatively small for multinomial logistic regression, potentially limiting the statistical power to detect subtle or small effect sizes across all outcome categories (Long and Freese, 2014; Peduzzi et al., 1996). Consequently, while the model identifies primary trends, the absence of significance for certain predictors should be interpreted with caution rather than as definitive proof of no effect.

This study suggests several practical implications. First, incorporating vocational interest assessments into academic advising may enhance the alignment between students' individual

profiles and their chosen fields of study. Online self-assessments (Steiner, 2024), based on Holland's model (1997) and complemented by personality frameworks such as the Big Five Inventory, can serve as diagnostic tools both for study choice and for identifying attrition risks. Such individualized feedback not only supports institutional strategies for student retention but also enables timely interventions when students' vocational interests or personality traits indicate potential misalignments with disciplinary demands. However, these implications for vocational assessment and counseling are particularly relevant for high school students and first-semester university students, for whom study and career orientation processes are still formative; they may be less meaningful for students in the intermediate or final stages of undergraduate study and for graduate students, whose academic and vocational trajectories are already more defined. Second, the findings hold implications for curriculum design. Embedding modules or learning opportunities aligned with the predominant vocational interests of rehabilitation education students may foster stronger engagement and greater study satisfaction. Creating thematically tailored contexts or integrating innovative, interest-driven formats could enhance perceived relevance and motivation, thereby advancing both academic achievement and the development of professional identity among students in rehabilitation education.

As a result of our research, several new questions arise. It is particularly important to investigate whether the findings can be generalized beyond Germany. In this regard, international comparative studies would be valuable. Another challenge is to examine the influence of the cluster solutions on academic outcomes, such as intentions to drop out of a study program or levels of study satisfaction. Longitudinal studies should be conducted to explore whether professional interests among students in rehabilitation education are stable over time. Moreover, it would be desirable to investigate how such interests emerge, for instance, through genetic predispositions or environmental factors.

Furthermore, future research should test the RIASEC clustering in other professional and occupational fields. While our study focuses on rehabilitation education, applying this method to different disciplines would help to see if these patterns are universal. The current findings provide a strong rationale for such broader investigations across various work contexts. By comparing different groups, researchers can better understand how vocational interests combine in diverse career paths. This approach will strengthen the overall validity of using cluster-based models in vocational psychology.

Conclusion

An initial analysis of students' vocational interests based on Holland's typology (1997) from university students in rehabilitation education revealed notably high ratings in the social and artistic domains. To explore underlying patterns within these interest profiles, an exploratory cluster analysis was conducted. This analysis identified three empirically derived clusters: the Pragmatic-Analytical Group, the Creative-Inspired Group, and the Lower-Interest Group. Membership in these clusters was significantly predicted by the Big Five personality

traits. These findings may provide valuable insights for career and study counseling as well as for the development of university-level curricula, thereby offering practical applications.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethics Committee of TU Dortmund University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MM: Resources, Conceptualization, Project administration, Writing – review & editing, Supervision, Writing – original draft. SW: Writing – review & editing, Formal analysis, Writing – original draft, Resources, Project administration, Methodology, Visualization, Data curation.

Funding

The author(s) declared that financial support was not received for this work and/or its publication.

Acknowledgments

We would like to thank Luana M. Gaiser Furtado (TU Dortmund University) for carefully reviewing the manuscript

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and offering many insightful suggestions that helped improve its clarity and language.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2026.1782121/full#supplementary-material>

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