Optimizing Career Guidance in Secondary Education: Exploring Person-Environment Interest Fit with the SIMON-jr Interest Inventory

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Abstract

Vocational interests and person-environment (PE) interest fit are key predictors of academic and career outcomes, yet little is known about their role in early adolescence. The present study addresses this gap by exploring the role of PE interest fit in early adolescence. We introduce SIMON-jr, a freely accessible questionnaire for assessing vocational interests in early adolescents. Using SIMON-jr, we examined how students' vocational interests in the first year of secondary education fit with their study program choices by the third year, and how this fit relates to academic achievement. Additionally, we explored potential differences in interest fit between boys and girls. Our results confirmed the reliability and validity of SIMON-jr, establishing the tool as a robust and equitable resource for guiding students in their educational choices. Furthermore, our findings indicated that secondary students tend to select education programs that fit their interests, with girls showing a stronger fit than boys. At the same time, interest fit did not relate to academic achievement at this young age. We address several reasons for this lack of association, and highlight the potential of career education tools that assess PE interest fit to support early adolescents in making informed academic decisions.

Keywords: vocational interests, RIASEC, person-environment (PE) interest fit, early adolescence, career education

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Each student's process of choosing a study program in secondary education culminates into a decision that is expected to align with the student's interests and skills (Nauta, 2010; Slot et al., 2021). In reality however, students often make this decision with limited information. Many twelve-year-olds (and their parents) lack a clear understanding of what a particular study program entails, or underestimate the long-term consequences of their choices (Goosen et al., 2017). Moreover, study decisions are typically driven by presumed cognitive levels and academic demands, while actual domain interest usually plays only a minor role. This tendency is concerning, as research indicates that a good fit between personal interests and the educational environment significantly benefits study completion, career satisfaction, and overall success (de Vries et al., 2024; Nye et al., 2012). Recognizing these challenges, the present study adopts an interest-oriented approach to explore its potential advantages in supporting student's educational choices in secondary education.

Vocational interest assessment and the evaluation of person-environment (PE) interest fit—the congruence between an individual's vocational interests and the interests sparked in the environment—have proven to be valuable tools in career education, particularly in studies involving adults and late adolescents (Fonteyne et al., 2017; Hanna et al., 2021; Schelfhout et al., 2021a). PE interest fit provides a structured framework that supports individuals in exploring options and engaging in reflective analysis of their personal preferences (Schelfhout et al., 2021b), two critical components of effective career education (Hughes et al., 2016; Kuijpers & Scheerens, 2006). However, despite the essential educational and career-related decisions that students face in early adolescence (Seghers et al., 2019), PE interest fit has been largely overlooked at this developmental stage (Su, 2020).

As a first research goal, the present study therefore introduces the SIMON-jr (SIMON-

junior), a newly developed, publicly accessible questionnaire, available in Dutch, designed to measure vocational interests in early adolescents (aged 11 to 14). With this new instrument, we address the need of Flemish education for additional and easy accessible (i.e., free) tools to guide students in early adolescence study choices. Instead of translating or adapting instruments developed in other regions, we developed a new instrument specifically tailored towards the Flemish adolescent population and the specific and somewhat unique Flemish education context, much like the already freely available SIMON-I for older Flemish students (Fonteyne et al., 2017).

As a second research goal, we use the SIMON-jr to analyze the degree of PE interest fit between students' vocational interests in the first year of secondary education (ages 12-13) and their study choices by the third year (ages 14-15), as well as how this fit relates to academic achievement. By focusing on this age group, our findings aim to provide study counselors with valuable insights to improve decision-making guidance and support the development of career guidance tools tailored to the needs of early adolescents.

Vocational Interests

Research on PE interest fit often relies on Holland's theory of vocational interests (1997), which is still one of the most influential frameworks in vocational literature. The theory's central premise posits that individuals are more likely to thrive in educational and occupational settings that fit their interests. Holland identified six primary dimensions—Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (RIASEC)—to classify both individuals' interests and their environments, allowing for consistent, commensurate measurement across both. Holland's theory has been empirically verified and to this day still inspires the development of numerous interest inventories (for a more comprehensive overview, see also Hanna & Rounds, 2020), linking interests with academic subjects and career paths across various contexts (Fonteyne et al., 2017; Lasselle et al., 2021;

Lavrijsen et al., 2021; Nauta, 2010).

The RIASEC interests are typically arranged in a hexagonal pattern, reflecting a circumplex structure (Tracey & Rounds, 1996). According to Holland's theory (1997), adjacent interest types on this hexagon exhibit stronger correlations (e.g. R-I, I-A, A-S) than those that are further apart (e.g. R-S, I-E, A-C; Bullock-Yowell & Reardon, 2024;Nauta, 2010). This structure implies that as individuals score higher on one vocational dimension, they are likely to score lower on its opposing dimension (Nagy et al., 2010; Nauta, 2010).

However, recent literature in career counseling and vocational interests increasingly recognizes the complexity of interest structures, suggesting that individuals can hold multiple vocational interests simultaneously, especially in early adolescence (Slot et al., 2021). Holding an interest in multiple RIASEC dimensions has important ramifications, especially towards constructing interest profiles for a student (or a study program). As an example, one of the earliest and still commonly used methods to construct an interest profile consists of high-point letter coding, in which only the most dominant (or high scoring) RIASEC dimensions are represented through letter combinations like R (highest scoring dimension only), RI (highest and second highest scoring dimension, respectively), or RIA (Schelfhout et al., 2021b). A limited and letter-only profile can thus underestimate and obfuscate the actual interests of a student. For interest guidance and counseling, it is therefore recommended to incorporate scores on all six RIASEC dimensions when matching a student to a study program (Slot et al., 2021; Xu & Li, 2020). As such, person – environment interest fit or PE fit represents the match of a student to a study program (Schelfhout et al., 2021a).

Person – Environment Interest Fit

Literature describes methods to obtain commensurate measures of individual and environmental profiles on the same RIASEC scale. An individual's RIASEC profile is typically obtained by completing a RIASEC interest questionnaire, which provides scores

across each of the six dimensions. To determine the profile of an environment, there are two commonly used methods (de Vries et al., 2024; Schelfhout et al., 2022). The *a priori* method assigns a RIASEC profile to a study program or occupation based on existing classifications such as O*NET or Holland Codes (Rounds et al., 1999; Rounds et al., 2021). The *sample-based* method generates a profile by calculating the average RIASEC scores of individuals within that environment. Here, individuals serve as representatives or *incumbents* of their chosen environment. Early research by Assouline and Meir (1987) already indicated that sample-based interest fit tends to show a stronger correlation with satisfaction than the a priori approach, supporting Holland's idea that people themselves shape their environments (Chartrand & Walsh, 1999).

Literature operationalizes PE interest fit using a number of different methods. Xu and Li (2020) categorized these different methods into three broad approaches: top-letter(s)-oriented, profile-based empirical, and profile-based conceptual. High-point coding approaches assess fit by examining whether the highest-scoring RIASEC dimension(s) of an individual align with the primary characteristic(s) of the environment, focusing exclusively on dominant interest fit. In contrast, profile-based approaches assess fit across the entire RIASEC profile. The empirical profile-based approach uses polynomial regression to estimate fit, capturing nuanced information through linear, curvilinear, and interaction effects (Schelfhout et al., 2022; Shanock et al., 2010; Wiegand et al., 2021). Finally, the conceptual profile-based approach evaluates fit by relying on environmental profiles and employs methods like profile correlation (Xu & Li, 2020). Profile correlation correlates the relative ranking of RIASEC interests across person and environment profiles, producing a correlation coefficient between -1 (complete misfit) and 1 (perfect fit).

When choosing a method to assess interest fit, predictive capability and interpretability of the method are key to ensure that the method aligns conceptually and empirically with its

intended use (Granillo-Velasquez et al., 2024; Xu & Li, 2020). In career education settings, research indicates that the profile correlation method might provide an optimal balance between predictive capability and interpretability, a balance that alternative methods struggle to replicate. For predictive capability, students tend to choose study programs of which the RIASEC profile strongly and positively correlates with their own profile (Schelfhout et al., 2021b). For interpretability, a correlation is a method common to research, with a clear interpretation of a good fit (i.e., values towards 1) and a bad fit (i.e., values towards -1) (Schelfhout et al., 2019). Therefore, the present study adopts profile correlation as operationalization of PE interest fit.

Person – Environment Interest Fit in Educational Contexts

Holland's (1997) theory suggests that people are attracted to environments that fit their interests and that individuals are more likely to thrive academically or professionally when working or studying in environments that match their interests (Hoff et al., 2020; Tracey et al., 2012). Recent meta-analyses show significant associations between PE fit and outcomes in both occupational (Hoff et al., 2020; Nye et al., 2017; Van Iddekinge et al., 2011) and educational contexts, including academic achievement, persistence, and satisfaction (de Vries et al., 2024; Nye et al., 2012). The strength of these associations varies depending on the conceptualization and measurement of vocational interests, with effect sizes of up to $r = .36$ (Nye, Butt et al., 2018; Nye, Prasad et al., 2018; Schelfhout et al., 2022).

Despite the established importance of vocational interests in shaping individuals' academic and professional development (Wille et al., 2020; Rounds & Su, 2014) previous research has primarily focused on adult and higher education populations (de Vries et al., 2024; Su, 2020). Only recently however, researchers are starting to investigate the role of vocational interests in shaping academic outcomes within secondary school settings. For instance, Slot et al. (2021) found that vocational interests influence educational choices

among lower secondary students (ages 14–15) in ways similar to college students' major selection (e.g., Pässler & Hell, 2012), particularly for students with dominant interests in specific dimensions. For example, students with an enterprising–conventional dominant profile predominantly selected the economics–society track, while those with a realistic–investigative dominant profile gravitated toward the nature–technology tracks. In contrast, students with non-differentiated profiles, including those with low, average, or broad interests across all dimensions, exhibited greater variability in their educational choices. Similarly, Lavrijsen et al. (2021) demonstrated that both vocational interests and cognitive abilities independently predict subject preferences in middle school students (ages 12-13), underscoring their significance in understanding students' educational and career paths. Lavrijsen et al. (2021) also highlighted how vocational interests can explain more nuanced distinctions between subject preferences. For example, students who scored high on the realistic interest dimension were more likely to prefer STEM subjects that integrate mathematics and science in applied contexts, while those with stronger investigative interests tended to favor traditional mathematics and science subjects. Related to these findings, Hyland et al. (2022) found that secondary students (ages 14-18) with interest–ability profiles closely aligned with specific knowledge areas consistently outperformed those with less alignment in terms of knowledge acquisition, even when the latter possessed higher overall ability levels. This finding underscores the vital role of vocational interests in determining not only the types of information students pursue but also the persistence and intensity with which they engage in that pursuit (Su, 2020).

Although the studies of Hyland et al. (2022), Lavrijsen et al. (2021) and Slot et al., (2021) highlighted the importance of assessing vocational interests in guiding secondary students, none have specifically examined PE interest fit between students and their secondary education programs, nor its relations with academic achievement. Addressing this

gap is crucial, as interest theory suggests that the fit between a student's vocational interests and their educational environment is a stronger predictor of performance than interests alone (Nye et al., 2012).

Sex Differences in Vocational Interests and Interest Fit

Sex differences in vocational interests are well-documented and emerge early in development. Among adolescents and adults, women typically show stronger Social, Artistic, and Conventional interests, while men often exhibit stronger Realistic and Investigative interests (Su et al., 2009). These trends are already evident in late childhood and early adolescence, with girls reporting higher Social, Artistic, and Conventional interests and boys favoring Realistic interests (Maurice & Bäumer, 2015; Tracey, 2002). Findings regarding Enterprising and Investigative interests are more mixed at this stage (Pässler & Hell, 2020; Xu & Tracey, 2016). Interestingly, the magnitude of these differences seems to evolve with age. For example, the sex difference in Realistic and Social interests is smaller during late childhood and early adolescence compared to older samples, whereas the gap for Artistic interests is larger (Pässler & Hell, 2020; Tracey, 2002; Xu & Tracey, 2016).

In addition to specific vocational interests, sex differences are also observed in the degree of differentiation within interest profiles. Girls tend to display more differentiated profiles, showing clear preferences for specific domains over others (Slot et al., 2021; Sung et al., 2017). In contrast, boys more often exhibit nondifferentiated profiles, characterized by broad, neutral, or low-level interests that do not strongly favor any particular domain. Differentiated profiles are linked to a more precise alignment between interests and educational or career choices, whereas nondifferentiated profiles often lead to more divergent paths (Schelfhout et al., 2021a; Slot et al., 2021).

Present Study

The present study aims to enhance career education by exploring the role of PE

interest fit in secondary education, using the SIMON-jr questionnaire as assessment tool. SIMON-jr is a newly developed, publicly accessible[1] questionnaire, available in Dutch, designed to measure vocational interests in early adolescents. The present study first examines the psychometric properties of SIMON-jr, focusing on the internal consistency of the six interest dimensions, the alignment with the RIASEC structure, and sex differences. While replicating the established sex differences with SIMON-jr would support the construct validity of the instrument, it is important to ensure that these differences reflect inherent differences between boys and girls rather than sex biases in the newly developed interest scales, and also regardless of the biological or environmental origin of such observed differences (which is not the focus of this study). This psychometric evaluation aims to confirm the reliability and validity of SIMON-jr in measuring vocational interests among early adolescents, ensuring the instrument serves as a robust and equitable resource for guiding students in their educational choices.

Following the psychometric evaluation, we first analyze PE interest fit by examining how students' vocational interests in the first year of secondary education (ages 12-13) align with their study program choices three years later (ages 14-15). Second, we assess whether this PE interest fit predicts academic achievement. Considering the literature on PE interest fit, which emphasizes that fit between individual interests and environmental characteristics benefits both personal and academic outcomes (de Vries et al., 2024; Holland, 1997; Nye et al., 2012), we hypothesize that (Hypothesis 1) students' vocational interests will align with the vocational characteristics of their study program and (Hypothesis 2) PE interest fit will be positively associated with academic achievement, regardless of the specific study program. Additionally, grounded in research suggesting that girls tend to display more differentiated interest profiles than boys, which are associated with stronger fit between their interests and

[1] The items and scoring of the SIMON-jr are provided in Appendix A.

study programs (Schelfhout et al., 2021a; Slot et al., 2021), we hypothesize that (Hypothesis 3) girls will achieve stronger PE interest fit compared to boys.

Method

Context

As our study examines PE interest fit within the context of Flanders, we begin by providing a brief overview of the Flemish secondary education system. In Flanders, compulsory secondary education is structured into three two-year cycles with increasing levels of specialization. The first cycle comprises two primary streams: the A-stream and the B-stream. The B-stream is specifically designed for students who have not met the minimum requirements of primary education (Flemish Government, n.d.). In contrast, the majority of students—86% in 2023-2024—are enrolled in the A-stream (Department of Education and Training, 2023). Despite offering a standardized curriculum, the A-stream introduces early tracking through optional courses, with schools offering options that align with the study programs they provide from the second cycle onward (Seghers et al., 2021). In the second cycle, students select a study program from one of eight domains (e.g. Language and Culture, STEM, or Sport), along with one of three "finalities": academic (preparation for higher education), vocational (preparation for workforce entry), or dual (preparation for both). Additionally, twelve cross-domain programs are available within the academic finality. Individual study programs are classified within this domain-by-finality matrix based on content similarities. The present study followed students from the first (ages 12-13) to the third year (ages 14-15) of secondary education.

Pilot Studies

Two pilot studies preceded the present study. Both pilot samples were recruited through school principals within our professional network. The studies were approved by the Ethical Commission of the Faculty of Psychology and Educational Sciences of Ghent University (reference number 2020/151). Informed consent for participation, as well as for data storage and use by the researchers, was obtained from both the participants and their parents.

In a first pilot study, we generated a first list of 190 items, with 147 activities and 43 professions, derived from the SIMON – I (Fonteyne et al., 2017)[2]. We also sought the input of two focus groups of four students each (age eleven to twelve) on the appropriateness of the items. By tailoring the SIMON-I framework to younger students, SIMON-jr extends a reliable career counseling tool to support students in secondary education. Additionally, drawing on the evidence from studies like the ICA-R (Tracey & Ward, 1998)[3], SIMON-jr ensures age-appropriate and theoretically grounded insights into early adolescents' vocational preferences.

In a second pilot study, we presented these 175 items to 426 students, again aged eleven to twelve. In line with similar instruments for young adolescents, our goal was to construct a short scale, with a limited amount of items for each RIASEC dimension (Tracey & Ward, 1998). We selected the final set of items following an iterative process in which we evaluated (1) the loadings on the items' own RIASEC dimensions (preferably > .50), (2) the items' cross loadings on the other dimensions (preferably < .25) and (3) the six highest loading items for each dimension. The final SIMON-jr. item set thus contained 6 items for each RIASEC dimension.

[2] a validated interest inventory extensively used in Flemish higher education to guide tens of thousands of students in exploring academic and vocational pathways.
[3] a U.S.-developed tool designed to assess RIASEC interests in children.

Participants

The present study draws on data from the Talentcenter Study[4], a longitudinal project following students in Flanders through the first three years of secondary education. The sample consists of $N = 868$ students who contributed data to at least one wave of data collection used in this study. About 10% of these participants reported a home language other than Dutch (10% unspecified). Additionally, 28% of the participants had parents who received a scholarship (financial status unspecified for 19%). In terms of parental education, 9% had one parent with a maximum education level of primary school, and 5% had both parents with only primary education or lower (unspecified for 11% of the participants).

During the first data collection (grade seven, September-November 2021), 833 students completed the vocational interest questionnaire (M_{age} = 12.02 years, SD_{age} = .55, 46% female). These students were enrolled in 23 different regular secondary schools across Flanders, with 730 students in the A-stream and 103 in the B-stream. During the final data collection (grade nine, January-February 2024), we obtained data on the chosen study programs of 606 students (M_{age} = 14.23 years, SD_{age} = .50, 45% female), spread across 36 different schools, with 582 also providing information on their academic achievement.

The research project[5] encompassing the present study was approved by the Ethical Commission of the Faculty of Psychology and Educational Sciences of Ghent University (reference number 2021/59). Both the parents of the participants and the participants themselves gave their informed consent for participation, as well as for storage and use of the data by the researchers.

Materials

Vocational Interests

The SIMON-jr inventory was used to assess students' vocational interests. This

[4] Note that "Talentcenter" is a proper name.
[5] Entitled: "Study orientation in secondary education".

inventory was specifically designed for the Flemish educational context, targeting early adolescents (aged 11 to 14). SIMON-jr is grounded in Holland's (1997) RIASEC interest model and comprises n = 36 items, with 6 items representing each interest dimension. For an overview of the individual items, we refer the reader to Appendix A.

Each item describes either an activity (26 items) or an occupation (10 items) associated with a particular interest dimension. Participants respond with "yes" or "no" to indicate if they would enjoy the specified activity or occupation. For each interest dimension, the percentage of "yes" responses is calculated, and these percentages create the participant's RIASEC profile. Details on internal consistency and structure are provided in the results section.

Study Environment Interest Profiles

Based on an independent data sample, we established an interest profile for each cell in the Flemish matrix (i.e., domain x finality) of study programs, as well as separate profiles for each of the cross-domain programs (see also the 'Context' section). Creating interest profiles for grouped study programs, rather than for individual programs is appropriate, as most programs within a cell displayed similar interest profiles. Detailed research methods for defining these interest profiles are provided in Appendix B.

Academic Achievement

Academic achievement was measured using the Grade Point Average (GPA) from the first trimester (September to December), reflecting a weighted average of assignments, tests and exams across all subjects. GPA data were reported by the school principal. Since standardized testing is not implemented for third-year secondary students in Flanders, GPA scores are derived from individual teacher assessments. This system can introduce variability, as grading practices may differ between teachers and subjects.

Procedure

Participants filled out the interest questionnaire as part of the longitudinal Talentcenter

Study. The survey, programmed in Qualtrics (https://www.qualtrics.com/), was conducted in the participants' classroom during regular school hours. Participants completed the questionnaire on an internet-enabled device (laptop, computer or tablet), and the class teacher and a supervisor of Ghent University were present. After a brief explanation, the participants were able to work independently on the test. No time limits were imposed.

For follow-up data in the third year of secondary education, school principals provided information on students' chosen study programs and academic performance. If students had changed schools, they were contacted via mail to supply details about their chosen study program and academic achievement. Nevertheless, most data were obtained through school principals.

Analyses

Analyses were conducted in SPSS (version 29.0; IMB Corp., 2022) and R (version 4.3.3; R Core Team, 2024). All R analysis codes as well as the variance-covariance matrix are available at: https://osf.io/esf8y/?view_only=aae3a86696c543c380b01dd3b375201d.

To assess the validity of SIMON-jr, we first examined the internal consistency of the RIASEC dimensions using Cronbach's alpha. The reliability coefficients are interpreted following the COTAN guidelines for evaluating test quality (Evers et al., 2010). These guidelines outline specific reliability criteria tailored to the intended use of a test, categorized into three main purposes: high stakes decisions, less critical individual-level decisions, and group-level research. According to COTAN, reliability coefficients are deemed sufficient if they range between .80 and .90 for high stakes testing, .70 to .80 for less critical individual decisions, and .60 to .70 for group-level research (Evers et al., 2010).

Second, the RIASEC structure of the SIMON-jr questionnaire was evaluated through confirmatory factor analysis (CFA) in R using the lavaan package (version 0.6.17; Rosseel, 2012). A six-factor model was tested using Diagonally Weighted Least Squares (DWLS)

estimation to account for the binary nature of the data (Xia & Yang, 2018). To examine the circular structure, we calculated Pearson correlations and conducted a Randomization Test of hypothesized Order Relations (RTOR), using the RANDALL package (Fonteyne et al., 2017; Tracey & Rounds, 1993).

Finally, to examine sex differences in vocational interests, we conducted Mann-Whitney U-tests[6]. A Bonferroni correction was applied to control for multiple testing, setting the adjusted significance threshold at $p < .0083$ (= .05/6). Furthermore, to ensure that the observed sex differences represent empirical disparities rather than item bias, we conducted a Differential Item Functioning (DIF) analysis using the difR package (version 5.1; Magis et al., 2010). For the DIF analysis, we used Mantel-Haenszel method with continuity correction and the interest score as matching variable for DIF detection.

The interest fit between person and environment was operationalized using profile correlation, a method that correlates the six RIASEC scores from a student's individual interest profiles with the six RIASEC scores from the interest profile of their chosen study program. These program profiles were generated using a sample-based approach, further detailed in Appendix B. To explore the association between PE interest fit and academic achievement, Pearson correlations were calculated. These analyses were also conducted separately for boys and girls to identify potential sex-specific patterns, with independent samples t-tests performed to assess whether differences in PE interest fit between boys and girls were statistically significant. To account for between-school variability in GPA grading practices, we also performed the same analyses on within-school standardized GPA scores.

[6] We used the Mann-Whitney U-test as the RIASEC scores are not normally distributed (see also Figure 1).

Results

SIMON-jr

Internal Consistency

All RIASEC dimensions showed sufficient to good internal consistency for group-level research (Evers et al., 2010). The Cronbach's alphas were, corresponding to the order of the RIASEC-acronym: .80, .83, .82, .79, .70 and .62.

Structure

The distribution of interests scores across each of the RIASEC dimensions is illustrated in Figure 1. Means and standard deviations for each dimension, with separate values for boys and girls, are presented in Table 1.

Figure 1

Distribution of Interests Scores across the RIASEC Dimensions

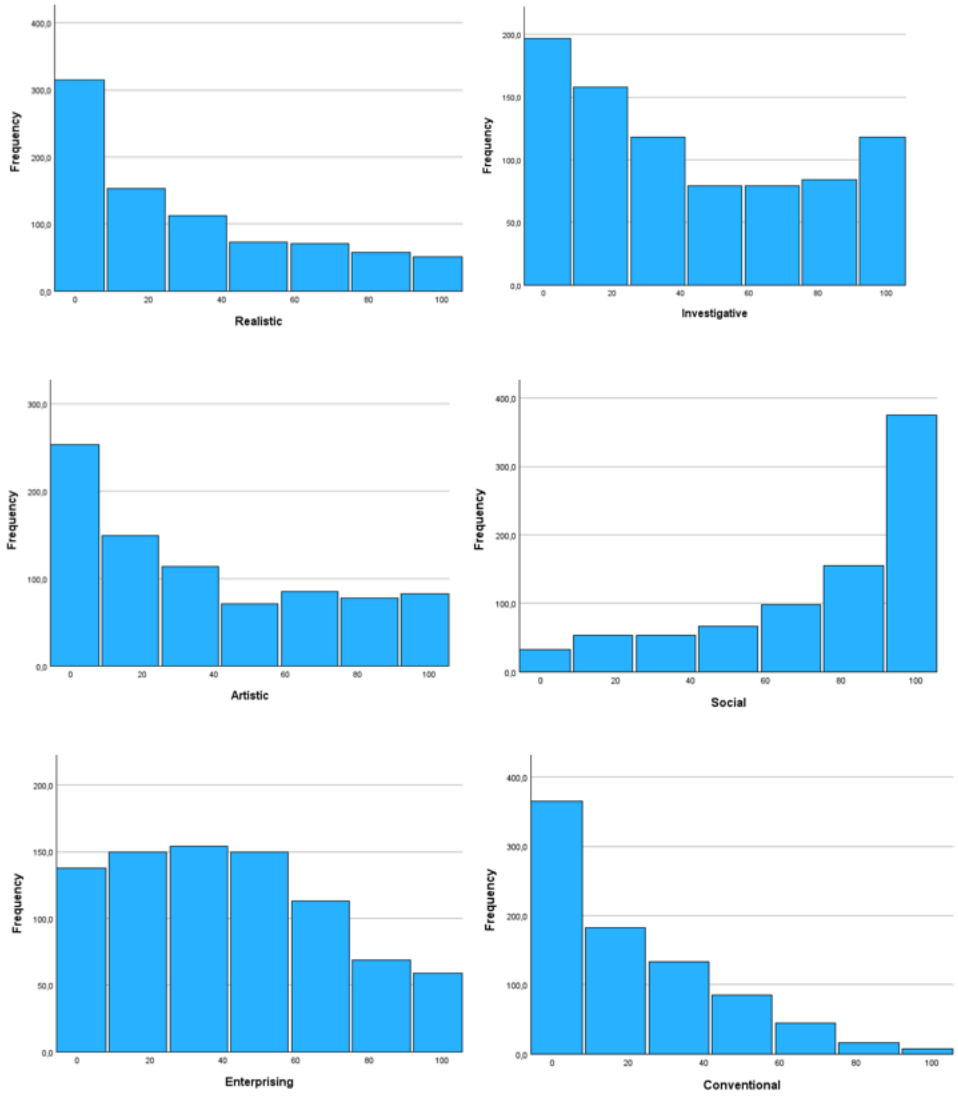

Table 1

Descriptive Statistics and Sex Comparisons for RIASEC Dimensions

	M *(SD)*	Boys: *M (SD)*	Girls: *M (SD)*	U	*p*	*r*
Realistic	29.53 *(31.99)*	43.56 *(33.80)*	13.11 *(19.59)*	130,894.00	<.001	0.47

Investigative	41.52	45.30	37.02	96,650.50	.001	0.11
	(*35.54*)	*(35.73)*	*(34.79)*			
Artistic	36.37	20.33	55.26	37,988.00	<.001	0.49
	(34.54)	*(24.79)*	*(34.97)*			
Social	75.57	67.11	85.61	55,185.00	<.001	0.32
	(29.94)	*(32.14)*	*(23.55)*			
Enterprising	41.20	48.30	32.81	111,121.50	<.001	0.26
	(29.93)	*(29.53)*	*(28.31)*			
Conventional	20.11	22.15	17.76	95,242.00	.003	0.10
	(23.39)	*(23.69)*	*(22.90)*			

Note. U = Mann-Whitney test statistics for comparing non-normally distributed data, *r* = effect size sex difference.

A CFA with the RIASEC-items serving as indicators for their respective latent interest dimensions (Realistic, Investigative, Artistic, Social, Enterprising, Conventional) confirmed an acceptable fit for the data: $\chi^2(579)$: 1,624.531; RMSEA: .047, 90% CI [.044, .049]; SRMR: .088; CFI: .965; TLI: .962. All factor loadings were significant, ranging from 0.549 to 0.960, indicating that observed variables reliably represent the underlying latent factors. The standardized factor loadings are presented in Appendix C.

Holland's predicted circular pattern was not confirmed (Table 2). For example, the R dimension should positively correlate the strongest with the adjacent I and C dimensions according to the predicted circular pattern. However, we observe that the alternate E dimension correlates more strongly with the R dimension than the I dimension does. These findings are further supported by the RTOR analysis[7], which yielded a correspondence index

[7] The RTOR analysis assesses the extent to which the RIASEC dimensions display a circular structure, expressed as a correspondence index (CI) ranging from 0 (no predictions confirmed) to 1 (all predictions confirmed). To obtain the CI, all correlations between all dimensions are ordered and compared (in pairs of two) to the ideal order as per Holland's theory. The CI then reflects the proportion of correctly ordered pairs.

(CI) of .32, with a p-value of .17.

Table 2

Correlations Between the RIASEC Dimensions

	1.	2.	3.	4.	5.	6.
1. Realistic	1					
2. Investigative	.03	1				
3. Artistic	-.20**	.02	1			
4. Social	-.15**	.10**	.38**	1		
5. Enterprising	.15**	.16**	-.12**	.08*	1	
6. Conventional	.16**	.27**	-.02	.14**	.47**	1

Note. *$p<.05$; **$p < .01$.

Sex Differences

Mann-Whitney U-tests revealed significant differences between boys and girls across all RIASEC interest dimensions, even after applying the Bonferroni-adjusted significance threshold ($p < .0083$; Table 1). Boys demonstrated stronger interests in the Realistic, Investigative, Enterprising, and Conventional dimensions, while girls exhibited stronger Artistic and Social interests. The largest differences were observed in the Realistic (effect size $r = .47$) and Artistic (effect size $r = .49$) dimensions.

The DIF analysis identified 13 items with (marginally) significant DIF (Table 3). Importantly, for all dimensions (except the Conventional dimension where only one item shows DIF), there is an equal number of items that favor boys and girls. These results indicate that although there is sex bias in some of the interest items, this bias does not systematically affect the interest scale scores of a specific group. The DIF analysis results for all items are presented in Appendix D.

Benchmarks for interpreting the CI are .70 for U.S. samples and .48 for international contexts (Rounds & Tracey, 1996).

Table 3

Items Displaying DIF

Item n°	Mantel-Haenszel χ^2	*p*	log odds ratio effect size (DeltaMH)
R4	4.32	.038	1.22 (B)
R6	14.22	<.001	-2.50 (C)
I1	17.85	<.001	-1.94 (C)
I2	5.16	.023	1.21 (B)
A1	14.18	<.001	1.89 (C)
A6	4.43	.035	-1.15 (B)
S4	11.08	<.001	-2.10 (C)
S6	7.45	.006	1.61 (C)
E1	3.63	.057	0.88 (A)
E2	3.63	.057	0.92 (A)
E4	4.33	.037	-1.00 (B)
E6	3.80	.051	-1.08 (B)
C5	10.46	.001	1.70 (C)

Note. Effect size code A = negligible effect; B = moderate effect; C = large effect (Magis et al., 2010).

PE Interest Fit

The mean PE interest fit was $M = .57$ ($SD = .32$). Comparisons between boys and girls revealed a significant difference, as an independent samples t-test with sex as grouping variable and PE interest fit as dependent variable showed that girls ($M = .61$, $SD = .30$) had a higher PE interest fit than boys ($M = .54$, $SD = .34$): $t(567) = -2.61$, $p = .009$, *Cohen's d* = -.22.

No significant association was found between PE interest fit and GPA at T3 ($r = .02$, $p = .57$). When analyzed separately, this lack of association held true for both boys ($r = -.02$, p

= .73) and girls (r = .03, p = .62). Analyses using within-school standardized GPA scores yielded similar findings: $r_{overall}$ = .02, $p_{overall}$ = .67; r_{boys} = -.04, p_{boys} = .49; r_{girls} = .04, p_{girls} = .53.

Discussion

The present study aimed to investigate PE interest fit in secondary education. While vocational interests, and specifically PE interest fit, have long been recognized as critical factors influencing academic and career outcomes, existing research has predominantly focused on adults or students in higher education. This focus leaves early adolescents largely understudied, despite the significant educational and career-related decisions early adolescents face during this formative period (Seghers et al., 2019). Given the proven value of PE interest fit in career education for older populations—where it has been shown to encourage exploration and self-reflection (Hanna & Rounds, 2020; Schelfhout et al., 2021b)—it is important to explore its potential in secondary education to help guide early adolescents in making informed and interest-driven choices.

The present study explored the fit between vocational interests and educational choices, potential sex differences, and the relation with academic achievement during early adolescence, using the SIMON-jr. The discussion will first address the validity of the SIMON-jr, followed by an analysis of the proposed hypotheses regarding PE interest fit.

SIMON-jr

We evaluated the psychometric quality of the SIMON-jr instrument across three key aspects: internal consistency (i.e., reliability), internal structure (i.e., construct validity), and sex differences (i.e., DIF). Regarding internal consistency, five dimensions (Realistic, Investigative, Artistic, Social, and Enterprising) exhibited reliability levels appropriate for less critical individual-level decisions (Evers et al., 2010), supporting their use in study

counseling practices. The Conventional interest dimension showed comparatively lower internal consistency (α = .62), though it still met the threshold for group-level research and fell within the reliability range observed in similar instruments, such as the Flemish ICA-R (Lavrijsen et al., 2021). While previous studies have also reported lower interest in the Conventional dimension compared to other RIASEC dimensions (Pässler & Hell, 2020; Lavrijsen et al., 2021), the current study shows a more pronounced difference. This finding may reflect genuinely lower interest in the Conventional dimension within our sample, but could also suggest that the Conventional items representing this dimension were less pronounced in reflecting the Conventional RIASEC type. Moreover, combined with the lower internal consistency results, we also deem it plausible that the Conventional RIASEC type is less distinguishable from the other (adjacent) RIASEC types in the Flemish population at this early adolescent age. Given these considerations, we suggest further research into the Conventional interest dimension to enhance understanding of both Conventional interests in early adolescents and SIMON-jr's ability to capture this dimension.

With respect to the internal structure, the CFA results demonstrated that the SIMON-jr aligns with the RIASEC framework. All factor loadings were significant, confirming that the SIMON-jr items reliably reflect the underlying RIASEC dimensions. The data did not support a circular structure, which aligns with prior research suggesting that the development of a circumplex relationship among interest scales typically emerges between seventh and eighth grade (ages 12-14) and becomes evident in eighth or ninth grade (around age 14-15; Tracey, 2002; Tracey & Rounds, 1993).

Our findings concerning sex differences in vocational interests align with commonly observed patterns in early adolescence. Specifically, boys reported higher Realistic interests, while girls exhibited stronger Social and Artistic interests, consistent with prior research (Maurice & Bäumer, 2015; Pässler & Hell, 2020). In contrast to commonly observed trends in

the Conventional interest dimension (Pässler & Hell, 2020; Su et al., 2009; Tracey, 2002), we found that boys showed stronger Conventional interests than girls. However, this result is not entirely unexpected as previous research within the same age group has also identified a reversed trend (Gfrörer et al., 2022). Furthermore, in line with previous findings in both early and late adolescent samples (Maurice & Bäumer, 2015; Su et al., 2009; Tracey, 2002), boys displayed stronger Investigative interests.

These findings regarding sex differences also highlight the importance of considering sex fairness in the SIMON-jr. DIF analysis showed bias in some individual items, though this bias was not systematically in favor of either boys or girls on any scale. These results suggest that while minor item-level differences exist, they do not undermine the overall fairness of the RIASEC scales. In other words, the observed DIF does not disproportionally steer either boys or girls towards a specific RIASEC dimension.

In summary, our results support the reliability and validity of SIMON-jr for assessing vocational interests in early adolescents. The instrument proves a reliable and fair tool, that produces valid interest measures, which also make the tool a valuable resource for guiding students towards informed educational choices.

PE Interest Fit

Regarding the PE interest fit, our findings suggest that students generally select secondary education programs that fit reasonably well with their interests, with a mean fit of .57, supporting Hypothesis 1. However, this value is lower than the mean fit of .70 typically observed in higher education (Schelfhout et al., 2019). This difference aligns with existing literature, which indicates that early adolescents are often still in the process of developing their vocational interests (Slot et al., 2021; Sung et al., 2017). As adolescents grow older, their vocational interests typically become more differentiated and specific (Tracey, 2002). This increased differentiation leads to a stronger alignment between students' interests and

their educational choices, resulting in a better match between their personal RIASEC interest profiles and chosen programs (Schelfhout et al., 2019). Research on older students also indicates that female students tend to experience a better fit with their selected programs (Schelfhout et al., 2021a). The present study further supports the claim of a stronger PE fit for girls, even at a younger age. Finally, the link between profile differentiation and PE fit differences between boys and girls also seems present at a younger age, as literature already features earlier studies on more differentiated female interest profiles during early adolescence (Slot et al., 2021; Sung et al., 2017).

Another factor that may contribute to the lower PE fit in secondary education compared to higher education is the broader, more general nature of secondary education programs, particularly in academic tracks. Future research could investigate this explanation further by comparing the PE interest fit between vocational education programs, which typically offer more specialized curricula designed to prepare students for specific professions, and more academic programs, which, despite some unique characteristics, provide a broader and less specialized curriculum. To explore this explanation, we conducted an independent samples t-test using vocational education at T3 (yes or no) as the grouping variable and PE interest fit as the dependent variable. The analysis revealed that students in vocational education exhibited slightly higher PE interest fit (M = .62, SD = .28) than those in more academic tracks (M = .58, SD = .32). However, this difference was not statistically significant, $t(507) = -1.04$, p = .30, Cohen's d = -.12. Notably, there was a substantial disparity in sample sizes between the two groups, with only 93 students in vocational education compared to 416 in more academic tracks. Therefore, further research is recommended to more comprehensively examine the relationship between program type and PE interest fit.

Concerning the relationship between PE interest fit and academic achievement, our

findings did not support Hypothesis 2, which predicted a positive relationship. Instead, no significant relationship was observed, nor when analyzing boys and girls separately. This result aligns with the findings of de Vries et al. (2024), whose meta-analysis reported only a small positive association between PE interest fit and academic achievement in higher education (ρ = 0.10, 95% CI [0.05, 0.14]). De Vries et al. (2024) attributed this weak relationship to the larger within-program variation in RIASEC profiles in educational settings compared to occupational contexts. Educational programs often prepare students for a broad range of careers rather than targeting a specific vocation, leading to greater diversity in program environments and smaller correlations with academic outcomes. This explanation is likely even more pronounced in secondary education, where study programs tend to be less specialized and more general compared to higher education, potentially accounting for the absence of a relationship in our study.

Two additional factors may further contribute to the absence of a relationship with academic achievement. First, most students in our sample exhibited a relatively high degree of interest fit with their chosen program (67% had a PE interest fit above .50). A high overall level of PE interest fit results in a restricted range, which may reduce the detectability of its potential impact on academic achievement (Tracey et al., 2012).

Second, the absence of a correlation may also be influenced by how academic achievement was operationalized in this study. Academic achievement was measured using GPA, which reflects performance across a broad curriculum encompassing general subjects such as mathematics, language, history, and ICT, regardless of the chosen program. These general subjects often do not align with students' specific vocational interests and are typically excluded from higher education curricula unless they are directly related to the chosen field of study. The principle of correspondence suggests that predictive accuracy improves when the level of generality or specificity in both the predictor and outcome is

aligned (Irving & Smith, 2020). Applying this principle, the general nature of GPA makes it a potentially less suitable measure for investigating the effect of interest fit on academic achievement, as it fails to directly capture students' vocational preferences. Future research could address these limitations by examining performance in program-specific subjects (e.g., mechanics, Latin, biology, physics, economics) that align more closely with students' vocational interests and chosen programs. Such an approach may provide a clearer understanding of the relationship between PE interest fit and academic outcomes in secondary education.

Practical Implications

Although vocational interests are still developing during early adolescence, students are already required to make educational and career-related decisions (Seghers et al., 2019). Our results show that students seem to achieve a fairly high PE interest fit with their chosen study program. However, the observed PE fit measures are not yet as high as they could be, indicating that student choices could still benefit from more information. Indeed, choosing a study path is a complex process, and both students and parents often seek guidance and information. Exploration tools like SIMON-jr can play a valuable role in this process. By assessing the fit between personal interests and available study programs, SIMON-jr encourages reflection and exploration (Holland, 1997) and may highlight study paths that might otherwise be overlooked, either because they are not well-known to students and parents or are not initially recognized as a good fit.

As such, SIMON-jr helps students make more informed choices by providing a clearer understanding of their interests and the educational options available to them. Moreover, this approach complements the often subjective recommendations of teachers by adding valuable objectivity (Seghers et al., 2019). Thus, while there is currently no evidence that SIMON-jr provides insight into students' chances of success within their chosen programs, the tool

remains a valuable resource for guiding study choices and pathway selection among early adolescents.

Limitations and Suggestions for Future Research

A first limitation concerns the developmental stage of the participants. Early adolescence is a formative period for vocational interest development, characterized by the ongoing crystallization and differentiation of interests (Slot et al., 2021). Since students' vocational interests are likely still evolving at this stage, longitudinal studies are needed to explore how vocational interests and interest fit develop over time, as well as how the SIMON-jr captures these evolving interests and predicts educational and career outcomes.

As a second limitation, we acknowledge that the present study describes adolescents with a specific and structural opportunity to choose an educational path. Future research efforts therefore need to acknowledge that such a context does not automatically generalize to all adolescent groups across diverse educational settings.

As a third and final limitation, our sample consisted primarily of students who were interested in their chosen study program. Only 8% of students reported a lack of interest when asked directly[8], “Do you find your study program interesting?”, and the relatively high levels of PE interest fit across the sample reflect this. While this supports the validity of SIMON-jr in capturing interest fit, the restricted range of interest fit may have made it more difficult to detect significant outcomes. Future research could address this limitation by actively seeking a more diverse sample, particularly by focusing on smaller samples of targeted students who have switched programs or dropped out. Investigating the interest fit of these students could provide valuable insights into the consequences of misaligned interests, such as disengagement, academic difficulties, or dissatisfaction with their program. This approach would contribute to a more nuanced understanding of how PE interest fit influences

[8]This question was included in the final data collection in the third year of the longitudinal Talentcenter Study.

educational choices and student success.

Conclusion

The present study supports the reliability and validity of SIMON-jr as an appropriate tool for assessing vocational interests in early adolescents. Our findings indicate that secondary students tend to select education programs that align with their interests, with girls demonstrating a greater interest fit than boys, likely due to more differentiated interest profiles at this developmental stage. No significant relationship was found between interest fit and academic achievement. These results highlight the potential of career education tools that assess PE interest fit in secondary education, as they may encourage exploration and reflection on personal interests and study options, helping students make informed academic and career decisions.

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Appendix A

SIMON-jr: Items and Order of Presentation

1. Een fiets herstellen
   (*repair a bike*)
2. Een filmpje over wetenschap bekijken (over techniek, natuur of de mens)
   (watch a video about science (about technology, nature or humans)
3. Toneelkostuums maken
   (make theater costumes)
4. Iemand troosten
   (comfort someone)
5. Mensen overtuigen om een huis te kopen
   (convince people to buy a house)
6. Controleren of mensen hun belastingen betalen
   (check if people are paying their taxes)
7. Een ijzeren tuinpoort maken
   (make an iron garden gate)
8. Werken in een laboratorium
   (work in a laboratory)
9. Een kunstwerk maken
   (create a work of art)
10. Mensen goede raad geven
    (give people good advice)
11. Een team leiden
    (lead a team)
12. Lonen berekenen
    (calculate salaries)
13. De motor van een auto herstellen
    (repair a car engine)
14. Leren over planeten
    (learn about planets)
15. Een schilderij maken
    (paint a painting)
16. Praten met mensen
    (talk to people)
17. De baas zijn
    (be the boss)
18. Controleren of de wet gevolgd wordt
    (check if the law is being followed)
19. Een tafel uit hout maken
    (make a table out of wood)
20. Mensen aan het lachen brengen
    (make people laugh)
21. Een bedrijf leiden
    (run a company)
22. Documenten opstellen, zoals een contract of een testament
    (draft documents, such as a contract or a will)
23. Mensen met problemen helpen
    (help people with problems)

24. Onderhandelen over lonen
    (negotiate wages)
25. Een knuffel geven
    (give a hug)
26. Onderhandelen over de prijs van een huis
    (negotiate the price of a house)
27. Automechanieker
    (auto mechanic)
28. Wetenschapper
    (scientist)
29. Kunstschilder
    (painter in art)
30. Rechter
    (judge)
31. Elektricien
    (electrician)
32. Onderzoeker
    (researcher)
33. Fotograaf
    (photographer)
34. Politiecommissaris
    (police commissioner)
35. Laborant
    (lab technician)
36. Artiest
    (artist)

Scoring:

Percentage of "yes" responses selected for the items corresponding to the specific interest dimension:

R = items 1, 7, 13, 19, 27, 31

I = items 2, 8, 14, 28, 32, 35

A = items 3, 9, 15, 29, 33, 36

S = items 4, 10, 16, 20, 23, 25

E = items 5, 11, 17, 21, 24, 26

C = items 6, 12, 18, 22, 30, 34

Appendix B

Constructing RIASEC Profiles for Third-Year Secondary Education Programs

To define the interest profiles of distinct study environments in the third year of secondary education, a sample-based approach was employed. Interest assessments were carried out over three consecutive academic years, beginning in 2021-2022, targeting third-year students to provide a comprehensive understanding of interest profiles within the target environment. The questionnaires were administered between January and May to ensure that students had completed at least one exam period. A total of 2,872 participants provided consent and completed the SIMON-jr interest inventory. For analysis, we included only the RIASEC scores of students who expressed a clear willingness to select their current study program again or a tentative willingness if they found the program interesting. This selection criterion resulted in a final sample of 2,486 participants (M_{age} = 14.43, SD_{age} = .67), of whom 46% were female (1% was unspecified), and 7% spoke a home language other than Dutch. Participants were drawn from various locations across Flanders. The RIASEC scores of students in each study environment were averaged across all six dimensions to generate a RIASEC profile for each environment. The SIMON-jr showed sufficient to good internal consistency across all RIASEC scales, with Cronbach alphas of .83, .88, .85, .83, .76, .67 for the respective interest dimensions. The number of students contributing to each study environment profile varied from 22 to 301, with a mean of 95.56 and standard deviation of 74.68.

Appendix C

Table C1

Standardized Factor Loadings (SE) for Six-factor CFA

Indicator	Factor 1 (R)	Factor 2 (I)	Factor 3 (A)	Factor 4 (S)	Factor 5 (E)	Factor 6 (C)
R1	.66					
R2	.79					
R3	.96					
R4	.77					
R5	.82					
R6	.81					
I1		.63				
I2		.86				
I3		.67				
I4		.91				
I5		.88				
I6		.92				
A1			.71			
A2			.94			
A3			.94			
A4			.93			
A5			.64			
A6			.68			
S1				.72		
S2				.79		
S3				.85		
S4				.75		
S5				.82		
S6				.78		
E1					.64	
E2					.55	
E3					.65	
E4					.70	
E5					.78	
E6					.83	
C1						.64
C3						.71
C3						.68
C4						.59
C5						.62
C6						.57

Appendix D

Table D1

Results of Differential Item Functioning Analysis

Item n°	Mantel-Haenszel χ^2	*p*	log odds ratio effect size (DeltaMH)
R1	2.20	.138	0.85 (A)
R2	2.85	.091	1.20 (B)
R3	2.97	.085	-1.28 (B)
R4	4.32	.038	1.22 (B)
R5	0.29	.587	-0.46 (A)
R6	14.22	<.001	-2.50 (C)
I1	17.85	<.001	-1.94 (C)
I2	5.16	.023	1.21 (B)
I3	2.93	.087	0.82 (A)
I4	0.00	.978	0.06 (A)
I5	0.13	.724	0.25 (A)
I6	0.00	.949	-0.13 (A)
A1	14.18	<.001	1.89 (C)
A2	0.19	.661	-0.36 (A)
A3	0.93	.334	-0.67 (A)
A4	1.61	.205	-0.99 (A)
A5	0.30	.582	0.31 (A)
A6	4.43	.035	-1.15 (B)
S1	0.28	.598	-0.42 (A)
S2	0.17	.681	-0.28 (A)
S3	0.55	.459	0.56 (A)
S4	11.08	<.001	-2.10 (C)
S5	0.32	.569	0.39 (A)
S6	7.45	.006	1.61 (C)
E1	3.63	.057	0.88 (A)
E2	3.63	.057	0.92 (A)
E3	1.28	.258	0.57 (A)
E4	4.33	.037	-1.00 (B)
E5	2.29	.130	-0.90 (A)
E6	3.80	.051	-1.08 (B)
C1	0.05	.831	-0.20 (A)
C2	1.39	.239	-0.68 (A)
C3	0.25	.616	-0.35 (A)
C4	3.40	.065	-1.12 (B)
C5	10.46	.001	1.70 (C)
C6	0.15	.697	0.23 (A)

Note. Effect size code A = negligible effect; B = moderate effect; C = large effect (Magis et al., 2010).