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Vocational choices in adolescence: The role of gender, school achievement, self-concepts, and vocational interests

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Highlights

- The role of gender, school achievement, self-concepts, and vocational interests in the transition to VET is examined.
- The sets of predictor variables had large proportions of variance in common.
- The profiles of students' construct scores resembled the characteristics of different groups of occupations.
- All variables under study were related to students' vocational choices.
- Vocational interests emerged as the most powerful predictors of the vocational choices.

Abstract

The present study examines the role of gender, school achievement tests, school grades, self-concepts, and vocational interests in predicting the transition from school to different fields of vocational education and training in a German sample of 10th-grade students ($N = 900$) attending intermediate secondary school. All sets of constructs were assessed with respect to multiple domains related to school subjects and the salient characteristics of occupations. Results showed that the sets of predictor variables had large proportions of variance in common (18% to 87%). On average, the profiles of students' construct scores resembled the characteristics of the different groups of occupations. Multinomial logistic regression analyses based on three alternative classification systems of occupations revealed that all variables were related to students' vocational choices, but that vocational interests were the most powerful predictors, and that the remaining variables only

had small ii
discussed.

Keywords

Transition from school to vocational education and training; Vocational choices; Gender; Vocational interests; School achievement tests; School grades; Self-concepts

1. Introduction

The transition from secondary school to postschool education marks an important developmental step in the occupational careers of young people. The choice of a specific vocation, which is connected to this step, is a developmental task which must be tackled during adolescence—a particularly sensitive period for young people. The completion of this task has implications for an individual's life path because the certificates acquired in postschool education determine subsequent career options (Graf, 2015). In many countries, such as the United States, Canada, and Great Britain, occupations that do not require a university or college degree are, in principle, open to all individuals who have completed high school. In many other countries (e.g., Germany, Austria, Denmark), however, entry into these occupations requires individuals to have finished vocational education and training (VET). In Germany, decisions regarding VET are usually made in Grade 10, when students are 16 years old. The majority of students who choose VET attend nonacademic school tracks, with the attendance of an intermediate secondary school being most typical for this population (Graf, 2015).

The study of the individual characteristics that underlie early career decisions has a long tradition. However, most studies so far have either focused on a small number of explanatory constructs (e.g., Päßler & Hell, 2012; also see Sheu et al., 2010 for an overview), or on specific career options (e.g., the choice of tertiary education in the field of science, technology, engineering, and mathematics (STEM) versus in the non-STEM domains; Garriott et al., 2013, Lent et al., 2010, Parker et al., 2012). This practice offers a limited perspective for identifying the most proximal predictors of adolescents' career decisions.

In this article, we aim to overcome that limitation by considering a broad array of explanatory constructs included in prominent theories of vocational and educational choices, such as the Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett, 1994), and the Expectancy-Value Theory (EVT; Eccles, 2009, Eccles and Wigfield, 2002), and known to be related to adolescents' postschool transitions, namely, gender (Sells, 1980), school achievement tests (e.g., Schoon, Ross, & Martin, 2007), school grades (Nagy et al., 2012, Patrick et al., 2011), self-concepts (Marsh & Yeung, 1997), and vocational interests (Päßler and Hell, 2012, Tracey and Hopkins, 2001). The variables were assessed with respect to multiple domains; students' profiles of knowledge (test scores and grades), self-perceived abilities (self-concepts), and interests were represented with respect to various school subjects and fields of work. These variables were used to predict students' vocational choices, coded by three different occupation classification systems. Drawing on a large and representative sample of German intermediate secondary school students facing a normative transition to VET, our study provides important information about the constructs most closely linked to the vocational choices of adolescents.

This article was guided by several research aims. First, we investigated the strengths of the multivariate relationships between the domain-specific measures of school achievement tests, school grades, self-concepts,

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the predictions drawn from the SCCT (Lent et al., 1994) and the EVT (Eccles, 2009). Second, we evaluated the strengths of the relationships between each group of constructs and students' vocational choices and compared the corresponding results with the importance of each group of constructs for predicting postschool decisions as assumed by the SCCT and the EVT. Third, we investigated the relative utility of each group of constructs for predicting students' vocational choices when all constructs were simultaneously considered in light of the SCCT and EVT.

1.1. Key theories of educational and occupational choices

Research on career-related postschool transitions has a longstanding tradition (e.g., Sells, 1980). Most research in this field can be categorized as either focusing on the hierarchical or on the content-related aspects of career options. The former type of studies refers to the social and economic status associated with different occupations. Most studies conducted in this tradition focus on sociological characteristics (e.g., Hauser, 2010, Hillmert and Jacob, 2010), or on general cognitive capacities (e.g., Schmidt & Hunter, 2004) as predictor variables. In contrast, investigations of the latter type focus on content differences between occupations. Occupational and educational options are described with respect to the prototypical profiles of activities, opportunities, and demands (e.g., Flores et al., 2010, Parker et al., 2012). Therefore, explanatory constructs are typically considered to be content-specific, such as mathematical self-efficacy beliefs as opposed to general self-efficacy beliefs (e.g., Fouad and Smith, 1996, Garriott et al., 2013). In this article, we focus on the content aspect of vocational options.

According to recent theories of vocational and educational choices (e.g., Eccles, 2009, Eccles and Wigfield, 2002, Lent et al., 1994), commonly employed constructs refer to ability indicators, such as standardized test scores and school grades (e.g., Nagy et al., 2012, Schoon et al., 2007), self-perceptions of abilities or self-efficacy beliefs (Lent et al., 1994, Marsh and Yeung, 1997), as well as indicators of domain-specific value ascriptions, including domain-specific interests (Eccles, 2009, Lent et al., 1994, Nagy et al., 2006). Up until now, the most widely known theories considering these constructs are the SCCT, which is rooted in vocational psychology, and the EVT, which was developed in educational research.

Lent et al. (1994) argued that the SCCT integrates constructs that different career theories have in common. The SCCT includes four different parts: the interest model, the choice model, the performance model, and the satisfaction model. The choice model outlines the relationships between explanatory constructs and vocational choices. According to the SCCT's choice model (Lent et al., 1994), individuals develop their goals to pursue academic and career-relevant activities that are consistent with their interests. Although interests are regarded as the most important variables shaping individuals' career-relevant preferences and decisions, individuals' self-efficacy beliefs (i.e., their beliefs about their capabilities to achieve particular levels of performance) and outcome expectations (i.e., their beliefs about the consequences of certain behaviors) are assumed to have additional effects on their decisions. However, as described in the SCCT's interest model, self-efficacy beliefs and outcome expectations are assumed to be most important for shaping individuals' interest development (Lent et al., 1994). More specifically, in the SCCT, it is assumed that the (learning) experiences acquired during childhood and adolescence affect interests mainly indirectly by shaping individuals' self-efficacy beliefs and outcome expectations (Lent et al., 1994, Schaub and Tokar, 2005). As a consequence, the abilities and skills developed in earlier years are assumed to manifest themselves in specific patterns of likes and dislikes (i.e., interests) by shaping individuals' patterns of domain-specific self-efficacy beliefs and outcome expectations (Lent and Brown, 2006, Sheu et al., 2010). As such, it might be argued that an important aspect of the SCCT is the domain-specific nature of the explanatory constructs considered (Lent & Brown, 2006).

Today, a large number of studies provides support for the main assumptions of the SCCT, with most results indicating that interests and self-efficacy beliefs are the most powerful predictors of career-relevant choices (e.g.,

educational and vocational choices are rather inconsistent (Lent, Lopez, Sheu, & Lopez, 2011). However, up until today, most applications of the SCCT have focused on only one domain (e.g., mathematics or science; Garriott et al., 2013, Navarro et al., 2007). This might be seen as a major shortcoming because individuals come into contact with learning experiences in different domains (e.g., school subjects) and are therefore likely to differ in their within-person patterns of domain-specific self-efficacy beliefs and outcome expectations, which—in turn—results in different individual patterns of likes and dislikes (i.e., interest profiles). Indeed, many researchers have argued that the configuration of domain-specific constructs plays a key role when considering choice behavior (Marsh, 2007). For example, individuals with high self-efficacy beliefs in one domain (e.g., mathematics) might be less likely to decide in favor of a math-intensive career if they also hold high self-efficacy beliefs in competing domains (e.g., social studies). In contrast, even in the case of relatively weak domain-specific self-efficacy beliefs, individuals might decide on the corresponding direction because they hold even lower self-efficacy beliefs in competing domains.

The EVT (Eccles, 2009) was developed in order to explain achievement-related choices typically encountered in educational settings, such as coursework choices and choices of tertiary education (e.g., Nagy et al., 2006, Parker et al., 2012). The EVT has many similarities with the SCCT because it considers constructs closely related to self-efficacy beliefs (i.e., self-concepts and expectations of success), interests (i.e., intrinsic values), and outcome expectations (i.e., utility value and cost). The EVT assumes that expectations of success, intrinsic values, utility values, and perceived costs directly affect choice behavior. Furthermore, in the EVT, it is assumed that the effect of self-concepts on choice behavior is partly mediated by interests. This assumption parallels the proposition made in the SCCT that the effects of self-efficacy beliefs on vocational choices are partially mediated by interests. Furthermore, similar to the SCCT, the proximal predictors of choice behavior are assumed to mediate the effects of abilities, which are subsumed under achievement-related experiences in the EVT. As in the case of the SCCT, the explanatory constructs employed in applications of the EVT are considered to be domain specific.

In many applications of the EVT, expectations of success and self-concepts (i.e., self-perceptions of domain-specific abilities) are used interchangeably (e.g., Eccles and Wigfield, 1995, Eccles and Wigfield, 2002), although they are considered to be different constructs in the original formulation of the EVT. Previous research has produced many findings that indicate that domain-specific interests and self-concepts most strongly affect individuals' educational and occupational choices (e.g., Parker et al., 2012). Furthermore, it has found that interests and self-concepts account for a large part of the effects of achievement and gender on choices (e.g., Nagy et al., 2006, Parker et al., 2012, Schoon et al., 2007). However, as in the case of the SCCT, most applications of the EVT focused on just one domain (e.g., Guo, Parker, Marsh, & Morin, 2015), or, at best, on two domains (e.g., Nagy et al., 2006, Parker et al., 2012).

Taken together, the SCCT and the EVT have many similarities. Both theories are domain specific and include constructs that are closely related to each other. Both theories explicitly address the key role of interests in predicting educational and occupational choices. Furthermore, although they have a different theoretical basis, self-efficacy beliefs and self-concepts are certainly closely related to each other on a conceptual as well as on an empirical level (e.g., Bong, Cho, Ahn, & Kim, 2012). As argued by Bong and Clark (1999), self-efficacy beliefs focus on cognitive evaluations of one's capabilities based on mastery criteria, whereas self-concepts share these cognitive components but, in addition, incorporate affective components. Despite these conceptual differences, most empirical studies indicate that these constructs are empirically closely related to each other, with correlations ranging up to $r > .90$ (e.g., Marsh, Dowson, Pietsch, & Walker, 2004). However, outcome expectations, as used in the SCCT, and utility values and costs, as used in the EVT, appear to be somewhat different from each other. We regard this distinction to be less important for this article because these constructs appear to be rather inconsistent predictors of choice behavior (Lent et al., 2011).

1.2. Profile

Many researchers have argued that focusing on constructs assessed with respect to a single domain is insufficient in providing a full explanation of the mechanisms underlying individuals' choices. For example, in the context of the Internal/External Frame of Reference model (IE model; Marsh, 1986), it has been argued that self-evaluations are based on the configuration of domain-specific self-concepts, i.e., individuals derive their self-views on the basis of ipsative-like internal comparisons. The hypothesis that ipsative comparisons affect domain-specific choices in school and postschool settings is supported by studies demonstrating that individuals' decisions to enter a specific type of tertiary education are not only positively influenced by high values on the corresponding self-concept domain (e.g., mathematical self-concept), but are also negatively influenced by high self-concepts in competing domains (e.g., verbal self-concept; Marsh and Yeung, 1997, Parker et al., 2012).

Most researchers assessing self-concepts with respect to different domains have distinguished between mathematics-related and verbal-related self-concepts. Many studies conducted in the context of the IE model indicate that individuals form their self-concepts in accordance with their achievement in the corresponding domains and subsequently consider educational or occupational options that match their pattern of domain-specific self-concepts (Nagy et al., 2006, Parker et al., 2012). Some studies drawing on the IE model have begun to also consider the role of academic interests assessed in multiple domains in school and postschool settings, with findings indicating that configurations of interests are more closely related to choice behavior than self-concepts are (e.g., Nagy et al., 2006, Nagy et al., 2008).

In a similar vein, most theories of vocational interests (e.g., Holland, 1997) argue that individuals' patterns of domain-specific likes and dislikes are key determinants of their vocational choices. A general assumption is that vocational choices are motivated by individuals' desire to establish a high correspondence between their patterns of likes and dislikes and the characteristics of occupational environments (Holland, 1997). Individuals look for occupations characterized by activities that match their highest interests and they avoid occupations that match disliked activities. Hence, theories of vocational interests highlight the importance of assessing interests with respect to multiple domains (Tracey & Hopkins, 2001).

Finally, research also documents the merits of considering achievement variables assessed with respect to multiple domains when predicting educational and postschool choices. Individuals with different university majors or in different occupational groups differ in their ability profiles, whereas the within-group profiles tend to correspond to the tasks most characteristic of the corresponding educational or occupational settings (Desmarais and Sackett, 1993, Humphreys et al., 1993, Prediger, 1989). In addition, some studies have shown domain-specific abilities to be significant predictors of subsequent occupational and/or educational choices (Humphreys et al., 1993, Lent and Brown, 2006, Patrick et al., 2011). Most recently, Davison, Jew, and Davenport (2014) provided evidence that individuals' patterns of verbal and quantitative College Board Scholastic Assessment Test scores predict choices of STEM majors in college.

Taken together, previous research provides evidence that the patterns of achievement scores, self-concepts, and (vocational) interests play a role in predicting educational and occupational choices. However, one limitation of large parts of the research so far is that the constructs considered were assessed in only a few domains (typically two). Furthermore, most studies did not combine multiple sets of constructs in predicting postschool choices. In this article, we aim to overcome those limitations by combining different sets of theoretically sound constructs assessed in many domains in our investigation of the role that they play in predicting students' postschool vocational choices. In order to do this, we first needed to specify the domains according to the abilities, self-perceived capabilities (i.e., self-concepts and/or self-efficacy beliefs), and interests that were to be assessed.

Focusing on students at the end of intermediate secondary education facing the transition to VET, we argue that the sets of constructs used should reflect both the school curriculum (i.e., school subjects), as well as the structure

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in which it is assumed that learning experiences play a major role in shaping self-efficacy beliefs and outcome expectations. Although the SCCT remains rather vague about the contexts in which learning experiences occur, school undoubtedly plays a major role. In western societies, adolescents spend a large part of waking hours in school, and school continues to have an impact on how they use their time at home due to the need to do homework and prepare for exams (Graf, 2015).

The school curriculum structures students' acquisition of knowledge and skills with school subjects. Furthermore, students receive systematic performance feedback through subjects (e.g., grades). They tend to compare their performance with their schoolmates within subjects, as well as their performance across subjects when forming self-views of their abilities (Marsh, 1986, Marsh and Yeung, 1997). Hence, learning experiences made available in schools provide the basis for the acquisition of subject-specific knowledge, and for the development of a sense of one's subject-specific capabilities.

In the present research, we measured the knowledge and skills acquired in school by means of school achievement tests and school grades. As the construction and assessment of achievement tests that cover all school subjects is not a feasible task, we focused on the main subjects, and additionally assessed achievement in several additional domains (hard sciences and economics) that were represented in the curriculum with a reasonable scope and also constitute key requirements in a significant number of occupations. Grades and self-concepts were assessed in the corresponding domains. In the case of self-concepts we decided to include an additional domain not covered by the school curriculum, namely, social interactions. We included this domain because social skills are considered to be a requirement in a variety of occupations, and all adolescents come into contact with (learning) experiences in a variety of settings that provide them with the opportunity to make a valid self-evaluation of social capabilities. Adolescents' interests are also clearly influenced by the school curriculum. As a consequence, many researchers who have investigated school-related choices, as well as postschool transitions, have focused on subject-specific interests (Nagy et al., 2006, Nagy et al., 2008, Parker et al., 2012). However, when looking at the transition from school to VET, we consider it more natural to focus on vocational interests. Interests represent the value and/or valence that individuals attach to objects, so that they form the basis of choice behavior (Heckhausen, 2000). Hence, in the case of vocational choices, it appears most natural to presume that individuals prefer vocations associated with higher values and valences. This line of reasoning is also found in the EVT, in which interests are subsumed under the heading "intrinsic values" (Eccles, 2009, Eccles and Wigfield, 2002). Furthermore, it is also in line with the SCCT, in which interest is assumed to be the most important determinant of vocational choices, which are—by definition—directed towards the world of work. As such, it is no surprise that many empirical studies inspired by the SCCT have used vocational interests (e.g., Patrick et al., 2011, Scheuermann et al., 2014).

For the present article we decided to use the well-validated taxonomy of vocational interests provided by Holland (1997). In this taxonomy, six domains of vocational interests are distinguished between: Realistic (*R*; dealing with physical or mechanical objects), Investigative (*I*; activities that involve thought, observation, and investigation), Artistic (*A;* work that is literary, and aesthetic), Social (*S*; tasks that involve socializing, helping, and teaching), Enterprising (*E*; work that involves leadership, business, and competition), and Conventional (*C*; preference for quantitative and structured tasks following clear rules). These domains are referred to collectively as RIASEC (for a detailed overview, see Holland, 1997). Despite being parsimonious, the RIASEC taxonomy has been proven to be a strong predictor of postschool choices (e.g., Päßler & Hell, 2012). Note, however, that even though vocational interest inventories have been developed with respect to the world of work, they are also related to actions and measures organized in accordance with the school curriculum. For example, vocational interests were found to be predictive of coursework choices (Volodina, Nagy, & Retelsdorf, 2015), and also appear to be systematically related to school grades and school achievement test scores (Nagy et al., 2012). Hence, these findings suggest that

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distinct types of work-related activities as assessed by the RIASEC taxonomy.

1.3. Hypotheses

As argued above, the SCCT and the EVT make similar assumptions about (1) the interrelations of the different arrays of constructs considered in this article, (2) the strengths of their relationships to students' occupational choices, and (3) their relative value for predicting postschool occupational choices. In the present article, we investigate hypotheses derived from the SCCT and EVT. However, in contrast to previous research, we examine the hypotheses on the basis of multivariate representations of the groups of constructs assessed with respect to different domains (see above).

Regarding the relationships between the groups of constructs, it can be first hypothesized that all groups of constructs considered here are related to each other:

Hypothesis 1a

Markers of abilities (e.g., test scores and school grades), self-efficacy beliefs/self-concepts, and interests show nonzero relationships to each other.

Furthermore, both theories imply the same patterns of the strengths of relationships between the different groups of constructs. The knowledge acquired in school, as reflected in school achievement tests and school grades, is primarily a result of learning experiences, which means that these two sets of variables share a common basis. In addition, both theories assume both constructs to be strongly related to students' self-perceived abilities, as reflected in their self-concepts. The SCCT, as well as the EVT, predicts that the relationship between the results/consequences of learning experiences, such as acquired knowledge and interests, is mediated by individuals' self-views of their capabilities. Therefore, the following hypothesis about the pattern of the strengths of the relationships between the groups of constructs can be derived:

Hypothesis 1b

Test scores and school grades are most strongly linked to self-concepts, which, in turn, have the strongest relationships to interests.

Regarding the relationships between the groups of constructs and students' vocational choices, the SCCT and the EVT imply that all groups of constructs considered in this article are related to students' choices:

Hypothesis 2a

Markers of abilities (e.g., test scores and school grades), self-concepts, and interests are related to students' vocational choices.

However, based on the SCCT and the EVT, it can be expected that the strengths of these relationships differ between sets of constructs. Therefore, the following hypothesis about the strengths of the relationships between sets of constructs under study was derived:

Hypothesis 2b

Of the considered groups of constructs, interests are most closely linked to occupational choices, followed by self-perceived capabilities, such as self-concepts (e.g., Nagy et al., 2006, Parker et al., 2012). Test scores and school grades exhibit weaker relationships to vocational choices because the SCCT and the EVT predict that the effects of test scores and grades on vocational choices are mediated by interests and self-concepts (referred to as self-efficacy beliefs in the SCCT; Eccles and Wigfield, 2002, Lent et al., 1994).

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the following hypothesis about the relative predictive contribution of the groups of variables was derived:

Hypothesis 3

Vocational interests are the strongest predictors of occupational choices (e.g., Humphreys and Yao, 2002, Päßler and Hell, 2012), and self-evaluations of capabilities (self-concepts) have additional significant effects on students' choices (e.g., Parker et al., 2012, Sheu et al., 2010). Direct markers of abilities (test scores and grades) do not add a meaningful contribution to the prediction once the remaining variables are simultaneously considered because the effects of these variables are expected to be mediated by self-views of abilities (i.e., self-concepts) and vocational interests.

In addition, we also considered the role of gender because this variable is inherently linked to variables associated with vocational choices (Sells, 1980). Gender is known to be strongly linked to self-concepts and interests (e.g., Nagy et al., 2006, Su et al., 2009), and significant relationships between gender and the profiles of test scores and grades also seem likely (Benbow, Lubinski, Shea, & Eftekhari-Sanjani, 2000):

Hypothesis 4

Based on previous research, we expected gender to be more strongly linked to motivational variables (i.e., self-concepts and interests) than to more cognitive measures (i.e., test scores and grades).

In the case of the relationships between gender and vocational choices, the SCCT and the EVT predict that effects of gender on occupational choices are mediated by self-concepts and interests. Therefore, the following hypotheses were also derived:

Hypothesis 5

Gender is less strongly related to vocational choices than self-concepts and vocational interests.

Hypothesis 6

Gender does not have an incremental effect on the prediction of postschool vocational choices once the remaining groups of constructs are included as predictor variables.

1.4. The present investigation

The goal of the present study was to extend the limited scope of many investigations targeted at predicting students' postschool vocational choices. Our aim was to study the relationships between a variety of sets of constructs and adolescents' vocational choices at the transition from school to VET. The population considered in this study is students at intermediate secondary schools, who typically enter an apprenticeship contract after Grade 10. This contract comprises extensive training in a specific vocation over a period of three years. The training is accompanied by school attendance two days per week. Once they have completed their training, students in VET obtain an occupational certificate that qualifies them for a specific occupation (Graf, 2015).

More specifically, our study focused on gender, school achievement tests, school grades, self-perceived capabilities (i.e., self-concepts), and vocational interests; these constructs have been identified as important predictors of educational and vocational choices in various theories in vocational and educational psychology (e.g., Eccles, 2009, Lent et al., 1994, Marsh and Yeung, 1997). We assessed the achievement-related constructs with respect to school subjects, thereby ensuring that the corresponding variables validly reflected the results of real learning experiences, as all students had the opportunity to acquire skills in the domains examined.

All variables were related to vocational choices, assessed in a large sample of adolescents facing a normative transition from school to VET. Given the broad array of explanatory variables and the large and representative

sample, our choices made by adolescents facing the transition to VET, it also offers more realistic estimates of the relative contribution of each set of constructs to the prediction of students' vocational choices than studies focusing only on single domains. Furthermore, by considering different sets of constructs assessed in multiple domains, our study provides the opportunity to examine the patterns of the strengths of the relationships between sets of constructs instead of focusing on the relationships between single measures. Hence, the present investigation makes a significant contribution to research on vocational choices because it makes it possible to examine key elements of the SCCT and the EVT on the basis of sets of domain-specific constructs.

1.5. Selecting the variables under study

In predicting the decision to enter specific fields of VET, we had to decide on a reasonable number of groups of predictor variables that belong to the different sets of constructs considered. As mentioned previously, achievement-related constructs were assessed with respect to the curriculum of schools (i.e., school subjects), whereas vocational interests were assessed with respect to Holland's (1997) RIASEC taxonomy of the world of work.

The choice of achievement measures (test scores and grades) was guided by several considerations. In order to represent the school curriculum as well as the requirements of a large array of occupations with a reasonable scope, we focused on the main subjects (i.e., mathematics, first language [i.e., German], and first foreign language [i.e., English]), hard science domains (technical knowledge [in physics], and biology), and economics. Grades and self-concepts were also assessed in the same domains (but grades in physics were considered to approximate technical knowledge). We also assessed self-concepts in technics, mathematics, German, English, and economics. Unfortunately, in the case of self-concepts, the data set employed did not include self-concepts in biology. However, we extended the list of self-concepts by including a measure of social self-concept, although this domain did not correspond to a specific school subject. We included this domain because social skills are considered to be a requirement in a variety of occupations (e.g., medical and health care sector), and we further believe that all adolescences came into contact with (learning) experiences in a variety of settings which provide the opportunity to develop a valid self-evaluation of social capabilities.

Overall, we believe that the domains selected to assess test scores, grades, and self-concepts also fit the RIASEC domains well (Holland, 1997). Technical knowledge and mathematical abilities are regarded as key ability requirements in *R*- and *I*-typed occupations (technical occupations), whereas knowledge in biology can be considered as an additional ability requirement mainly for *I*-typed occupations (e.g., laboratory assistant). Verbal abilities are key for occupations located in the *A* sector (e.g., advertising merchants), and are also important in many office occupations. Economical knowledge is probably most characteristic of occupations in the trading sector (*E*- and *C*-typed occupations), whereas social skills play a key role in occupations focusing on social interactions (*S*- and *E*-typed occupations). Hence, it can be expected that the domain-specific test scores, grades, and self-concepts assessed in this study are systematically related to vocational interests assessed according to the RIASEC domains.

2. Method

2.1. Participants

The data comes from the German study Transformation of the Secondary School System and Academic Careers, Grade 10 (TOSCA-10; Nagy et al., 2012). TOSCA-10 drew on a representative sample of $N = 2590$ 10th-grade students from 47 intermediate secondary schools and 20 academic secondary schools. In Germany, students are traditionally tracked into the different schools of the secondary system from as early an age as 10 (i.e., Grade 5).

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[Realschule], and academic secondary school [Gymnasium]) differ greatly in the intensity of the curriculum. The school tracks also differ in terms of the years of schooling provided and the school leaving certificate awarded. Lower secondary school students graduate after Grades 9 or 10, intermediate secondary school students after Grade 10, and academic secondary school students after Grades 12 or 13. The school leaving certificates issued by the lower and intermediate secondary schools qualify students to enter VET; vocational education is the only level for which they are eligible. Students who graduate from an academic secondary school are awarded the Abitur, which qualifies them for college entrance. In this study, we focused on those students from intermediate secondary schools who planned to commence VET ($N = 972$). Participants' average age was 16.78 ($SD = 0.64$), and 57.0% of the participants were female.

The remaining students from the intermediate secondary schools ($N = 1136$) opted for a transition to further secondary school education (97.1%), or were still undecided (2.9%). The number of students from academic secondary schools who indicated their willingness to commence VET was small (1.7%), and they were therefore not considered to be part of the target population. Thus, we did not include them in our analyses. From $N = 972$ students in our target sample, $N = 72$ had missing data on the dependent variable (i.e., desired job; see below). In order to investigate whether the missing data on the outcome variable (7.4%) depended on students' characteristics, we ran different logistic regression models in which we considered each set of predictor variables (i.e., gender, test scores, grades, self-concepts, and vocational interests) as predictors of missing rates. These analyses indicated that only test scores were significantly related to the likelihood of missing data [Wald-χ^2 ($df = 6$) = 16.47, $p = .011$]. A closer look at the variables' effect sizes indicated that this relationship was due to the verbal test scores, with the students who scored lower on the German ($OR = 0.93$, $p = .077$) and the English test ($OR = 0.96$, $p = .051$) having a higher likelihood of not reporting their vocational choices. However, as the amount of missing data was rather small, the variables' effects were weak, and significant only at the $p < .10$ level. Furthermore, as imputation procedures for multinomial data are not yet well developed, we concluded that deleting individuals with missing responses on the dependent variable was a viable option. Hence, we considered the $N = 900$ students who reported their vocational choices in the analyses in this article.

2.2. Measures

2.2.1. School achievement tests

Achievement in technical knowledge (Nickolaus, Gschwendtner, & Geissel, 2008), mathematics (Blum, Drüke-Noe, Hartung, & Köller, 2006), biology (Rosier & Keeves, 1991), economics (Schlegel, 2009), German (Kunter et al., 2003), and English (Rupp, Vock, Harsch, & Köller, 2008) was assessed with items taken from well-validated tests included in national and international large-scale studies (e.g., tests from the German Educational Standards, the Programme for International Student Assessment, among others; see Nagy et al., 2012 for an overview). Weighted likelihood estimates (WLEs) were calculated as person parameters for each student. The WLE reliabilities of the achievement measures were satisfactory (.63, .71, .61, .73, .74, and .86 for technical knowledge, mathematics, biology, economics, German, and English, respectively).

School grades in physics, mathematics, biology, German, English, geography, and civics in both half years of the Grade 10 were taken from the school records. School grades were coded such that high values correspond to better grades. As topics covering economics are covered by the school subjects of geography and civics, we averaged grades received in these subjects.

2.2.2. Self-concepts

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and economics (α = .84) were measured using the German adaptation (Schwanzer, Trautwein, Lüdtke, & Sydow, 2005) of the Self-Description Questionnaire (SDS; Marsh & O'Neill, 1984). The SDS is a multidimensional self-concept instrument for late adolescents and young adults. Previous research on the German SDQ instrument indicates its excellent construct validity and reliability (Marsh et al., 2006, Schwanzer et al., 2005), and there is some evidence for strong correlations between self-concepts measured by the SDS and measures of self-efficacy beliefs in corresponding domains (Bong et al., 2012, Marsh et al., 2004). Participants responded to each item (4 items per scale; sample items: "I have always been good at mathematics", "I'm just not good at English") on a 4-point response scale (from 1 = *strongly disagree* to 4 = *strongly agree*). As a proxy for social self-concept, we used four items from the Social Interaction Anxiety Scale (Stangier, Heidenreich, Berardi, Golbs, & Hoyer, 1999; α = .72; sample item: "When mixing socially, I am uncomfortable"). Social anxiety, which involves a view of the self as lacking in social skills, social value, and social character, can be generally characterized as a negative self-concept in terms of social behavior (Moscovitch, 2009). Items were recoded such that high scores indicate an absence of social anxiety.

2.2.3. Vocational interests

Vocational interests were assessed with the Revised General Interest Structure Test (GIST; Bergmann & Eder, 2005), an established German instrument based on Holland's model. The GIST is the instrument most frequently used in German-speaking countries. The test comprises 60 items, 10 for each of the six interest dimensions. Each item describes an occupational activity. Participants are asked to state how interested they were in each activity on a 5-point Likert scale (1 = *not at all* to 5 = *very much*). The validity information provided in the manual is positive: The GIST scales have repeatedly been shown to be highly reliable, to exhibit strong correlations with alternative interest measures based on the RIASEC taxonomy (Etzel et al., 2016, Jörin et al., 2004), and to conform to the circular structure hypothesized by (Holland, 1997; Nagy, Trautwein, & Lüdtke, 2010).The reliabilities in the present study were α = .88 for Realistic, α = .83 for Investigative, α = .85 for Artistic, α = .90 for Social, α = .87 for Enterprising, and α = .85 for Conventional interest domains.

2.2.4. Fields of vocational training

Participants were asked to report the field of VET to which they had applied (N = 677 valid answers) and their desired job (N = 900 valid answers). Their responses were coded on the basis of three alternative occupation classification systems, namely the German Classification of Occupations (GCO; Bundesagentur für Arbeit, 2010; nine occupational areas), the Standard Occupational Classification (SOC; Bureau of Labor Statistics, 2010; reduced to 18 occupational areas due to almost empty cells in the original classification), and Holland's (1997) RIASEC classification (six occupational areas). All analyses were performed with all three classification systems, and we present summarized results (e.g., percentage of correct classifications) for all systems. However, due to space restrictions, we only present detailed descriptive results for the GCO.

The GCO was developed with a particular focus on the characteristics of the German labor market. The GCO facilitates a compact representation of descriptive results, such as the presentation of domain-specific scores according to occupational groups, whereas the SOC (with 18 categories) is not a feasible system in this respect. In addition, the GCO was derived independent of the constructs investigated in this article, i.e., the GCO (as well as the SOC) does not appear to result in artificially inflated estimates of relationships between the different sets of constructs and vocational choices. This contrasts with the RIASEC-based occupation classification systems, which is typically derived on the basis of the average interest scores of incumbents of different occupations. As such, the RIASEC classifications appear likely to overestimate the relationships between vocational choices and vocational interests, and possibly to underestimate their relationships with other constructs.

All analyses contingency coefficients between the classification of fields of VET to which students had applied and their desired jobs were large (GCO: .86; SOC: .91; RIASEC: .81), and the results of all the analyses using the fields of VET applied to and the desired jobs were very similar. Hence, we only report the findings for the desired jobs because these recurred on a larger sample (the results of the analyses with the fields of VET to which students had applied are available upon request). Table 1 gives an overview of the classification of vocational choices, based on the GCO.

Table 1. Description of the German Classification of Occupations (GCO) as applied to the vocational choices of adolescents facing the transition to VET (N = 900).

	Description by GCO	Typical choices	% students	% female
OAF	Agriculture, forestry, farming, and gardening	Gardener, Zookeeper	2.4%	54.5%
OPR	Production of raw materials and goods, and manufacturing	Industrial Mechanic, Electrician	31.4%	15.5%
OCA	Construction, architecture, and technical building services	Architectural Draftsman, Engineer	6.0%	7.4%
ONS	Natural sciences, geography and informatics	Laboratory Assistant, IT Specialist	6.9%	24.2%
OTL	Traffic, logistics, safety and security	Police officer, Forwarding Merchant	5.2%	44.7%
OCS	Commercial services, trading, sales, hotel business and tourism	Office clerk, Shopkeeper	9.8%	60.2%
OBO	Business organization, accounting, law and administration	Banker, Industrial Management Assistant	17.9%	70.8%
OHC	Health care, the social sector, teaching and education	Speech Therapist, Hairdresser	14.7%	84.1%
OPL	Media, art, culture, design, literature, humanities	Journalist, Actor	5.7%	33.3%

2.3. Statistical procedures

2.3.1. Missing data

Missing data is a problem in all observational studies. A variety of algorithms have been proposed for dealing with missing data (cf. Newman, 2014). In the present data set, there were few missing values for all the predictor variables under study (max. 1.7% pro variable). As Little's (1988) test indicated that the actual pattern of missing data was fully in line with a completely random missing process ($\chi^2 = 75.28$, $p = .658$), we decided on a single imputation strategy utilizing the maximum likelihood based expectation maximization (EM) algorithm. The EM algorithm produces less biased estimates than pairwise or listwise deletion if data are missing completely at random or if the nonrandomness is predictable (e.g., Newman, 2014). Students' desired job and the fields of VET to which they had applied were not imputed.

2.3.2. Multivariate associations

In order to quantify the strengths of the associations between gender, the four sets of predictor variables (i.e., school achievement tests, school grades, self-concepts, and vocational interests), and the chosen field of VET, we

used a multi

we chose (Cohen, 1982) presents the proportion of variance shared between two sets of variables. R^2 has properties similar to the conventional squared multiple correlation and can be derived as 1 - Λ, where Λ is Wilks' Λ, which can be derived by means of a canonical correlation analysis or a discriminant analysis when categorical outcomes (i.e., fields of VET) are employed.

2.3.3. Nested data structure

As is typical for large-scale studies, students were nested within schools. Disregarding the dependencies induced by such a hierarchical structure is known to result in biased estimates of standard errors when testing hypotheses (Cohen, Cohen, Aiken, & West, 2003). To prevent such bias, significance tests were adjusted for the nested data structure by using the M*plus* 7.1 software (Muthén & Muthén, 1998-2012; M*plus* option: "Type = complex") employing a robust maximum likelihood estimator that is also robust to nonnormality (Arminger & Schoenberg, 1989). The corresponding analyses included mean comparisons and tests of the contribution of groups of variables to the prediction of adolescents' vocational choices that used multinomial logistic regressions. Both sorts of multivariate tests were based on the Wald-χ^2 test (Wald, 1943). The predictive power of multinomial regression models was judged by the percentage of correct classification (hit rates).

3. Results

3.1. Descriptive results

The first step in the analyses was to inspect the extent to which the conceptually derived relationships between domains in which self-concepts, test scores, and grades were assessed corresponded to the RIASEC domains of vocational interests. Table 2 provides the correlations of vocational interests with achievement tests, school grades, and self-concepts. The pattern of relationships was generally in line with our expectations.

Table 2. Correlations of self-concepts, test scores, and school grades with vocational interests.

	Realistic	**Investigative**	**Artistic**	**Social**	**Enterprising**	**Conventional**
Self-concepts						
Technics	.77**	.31**	− .27**	− .40**	− .19**	− .14**
Mathematics	.32**	.24**	− .20**	− .24**	− .11**	.06
German	− .28**	.01	.39**	.29**	.29**	.20**
English	− .18**	.02	.24**	.11**	.16**	.08*
Social	− .03	− .06	− .03	.06	.21**	.05
Economics	.13**	.30**	.06	.09**	.31**	.30**
Test scores						
Technics	.48**	.35**	− .24**	− .37**	− .17**	− .08*
Mathematics	.23**	.18**	− .10**	− .23**	− .15**	− .05
Biology	.18**	.24**	− .05	− .19**	− .11**	− .07*

German	− .06	.16**	.10**	.01	− .00	.05
English	− .16**	.05	.18**	.06	.01	.02
Economics	.11**	.24**	.01	− .09**	− .01	.05
School grades						
Physics	.20**	.25**	− .12**	− .13**	− .10**	.02
Mathematics	.10**	.13**	− .10**	− .13**	− .14**	.04
Biology	− .08*	.18**	.11**	.10**	.03	.14**
German	− .25**	.06	.29**	.24**	.18**	.19**
English	− .20**	.03	.19**	.07*	.04	.05
Economics[A]	− .08**	.11**	.09**	.09**	.10**	.17**

Notes: A = average of grades in geography and civics.

* $p \leq .05$.

** $p \leq .01$.

In the case of self-concepts, interests in the *R* and *I* domains exhibited the strongest positive correlations with technical and mathematical self-concepts. Interests in the *A* domain were most strongly linked to verbal self-concepts, but German self-concept was also positively related to *S*, *E*, and *C*. As expected, economics self-concept had the strongest positive relationships with interests in *E* and *C*, but correlated to a similar degree with *I*. Correlations between test scores and vocational interests were quite similar to the correlations between interests and self-concepts. However, mathematical achievement correlated somewhat more strongly with *R* than with *I*, and the German score was more strongly linked to *I* than to *A*, although both correlations were rather weak. Finally, test scores in biology were most strongly related to *I*. The pattern of correlations between school grades and vocational interests was very similar to the correlations between interests and self-concepts, although the strengths of the relationships were weaker.

In the next step of the analyses, we inspected the multivariate associations between the different sets of variables, as well as their relationships with vocational choices as coded by the three different occupation classification systems. As shown in Table 3, the sets of predictor variables shared a considerable amount of variance as expected by Hypothesis 1a. Furthermore, all sets of variables were clearly related to students' vocational choices as coded by the GCO, the SOC, and the RIASEC taxonomy. In line with Hypothesis 4 gender was most closely related to vocational interests, and also correlated more strongly with self-concepts as compared to test scores and grades. Achievement test scores had the strongest relationships with grades and self-concepts, whereas grades were most closely linked to self-concepts (Hypothesis 1b). Finally, self-concepts shared a considerable proportion of variance with vocational interests (Hypothesis 1b). In line with Hypotheses 2a and 5, all groups of constructs, as well as gender, were related to vocational choices. Vocational interests turned out to be the construct most closely linked to the fields of VET chosen by the students, followed by self-concepts (Hypothesis

2b). Self-co

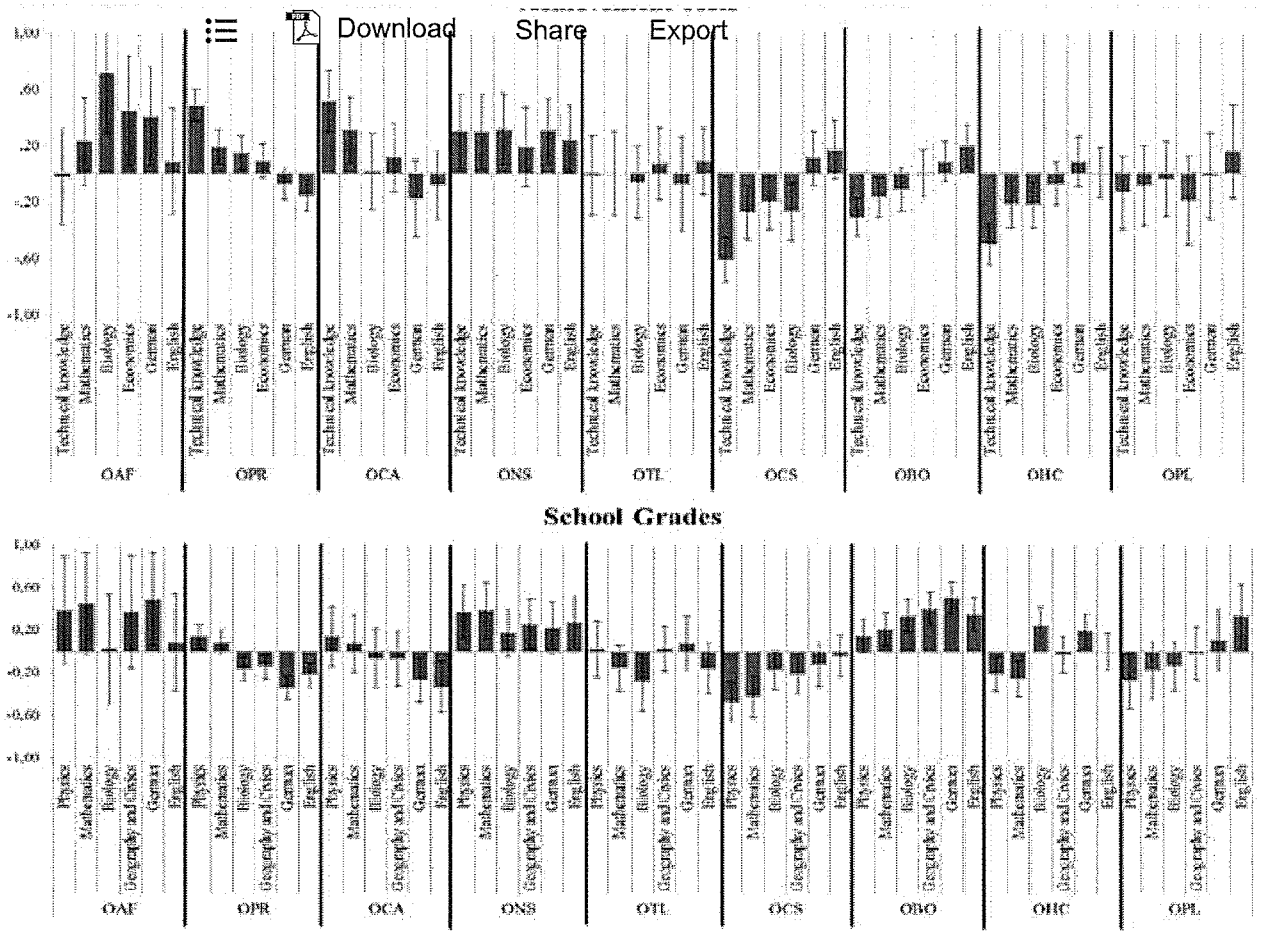
and grades showed relationships of similar size (Hypothesis 2b, Hypothesis 5).

Table 3. Variance shared between the sets of variables under study (R^2).

	Gender	Test scores	School grades	Self-concepts	Vocational interests
Student characteristics					
Gender					
School achievement	.24				
School grades	.18	.57			
Self-concepts	.33	.62	.87		
Vocational interests	.50	.46	.40	.78	
Vocational choices					
GCO	.31	.28	.26	.51	.86
SOC	.32	.34	.33	.54	.96
RIASEC	.31	.23	.19	.46	.88

Notes: GCO = classification of vocations according to the German Classification of Occupations, SOC = classification of vocations according to the Standard Classification of Occupations, RIASEC = classification of vocations according to the RIASEC taxonomy.

Fig. 1 provides the mean profiles of the z-standardized ($M = 0$; $SD = 1$) achievement test scores, school grades, self-concepts, and vocational interests of students opting for different vocations as coded by the GCO. Group differences in mean profiles turned out to be significant for all sets of variables: Wald-χ^2 ($df = 48$) = 330.25 ($p < .001$) for test scores, Wald-χ^2 ($df = 48$) = 264.96 ($p < .001$) for school grades, Wald-χ^2 ($df = 48$) = 741.43 ($p < .001$) for self-concepts, and Wald-χ^2 ($df = 48$) = 1195.62 ($p < .001$) for vocational interests. In addition, the proportion of female students also differed significantly between groups of occupations [Wald-χ^2 ($df = 8$) = 503.92, $p < .001$].



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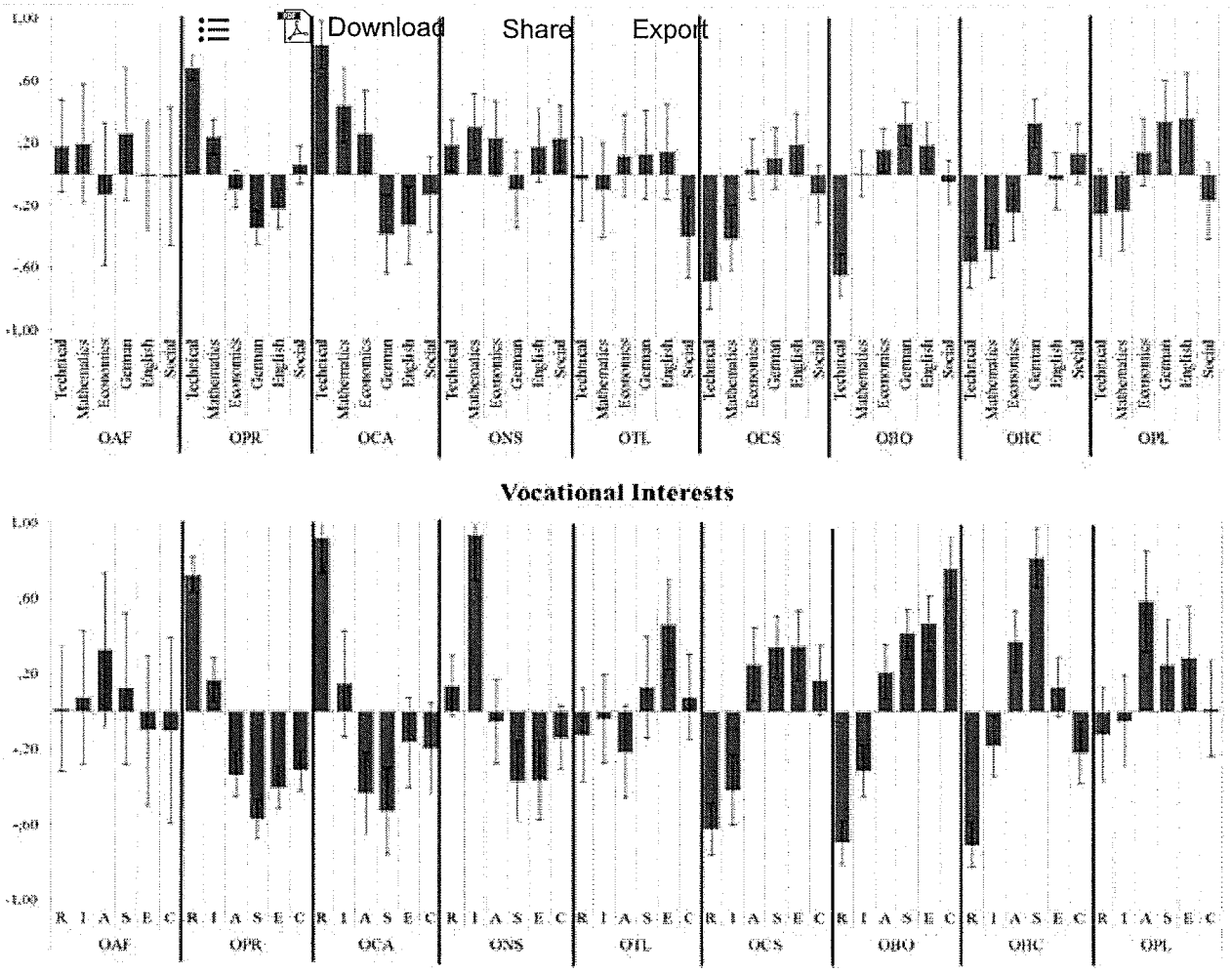

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Fig. 1. Mean profiles (including 95% confidence bands) for achievement tests, school grades, self-concepts, and vocational interests for the students' desired job as classified by the German Classification of Occupations (GCO) (N = 900). *Notes:* OAF = occupations in agriculture, forestry, farming, and gardening, OPR = occupations in production of raw materials and goods, and manufacturing, OCA = occupations in construction, architecture, surveying and technical building services, ONS = occupations in natural sciences, geography and informatics, OTL = occupations in traffic, logistics, safety and security, OCS = occupations in commercial services, trading, sales, the hotel business and tourism, OBO = occupations in business organization, accounting, law and administration, OHC = occupations in health care, the social sector, teaching and education, OPL = occupations in philology, literature, humanities, social sciences, economics, media, art, culture, and design. R = Realistic, I = Investigative, A = Artistic, S = Social, E = Enterprising, C = Conventional.

As shown in Fig. 1, group differences in the profiles of test scores, school grades, and self-concepts appeared to be structured according to a bipolar order of domains, with one pole characterized by technical knowledge or physics and mathematics (hard sciences), and the second pole by German and English (verbal). Students opting for vocations classified as OPR and OCA had their relative strengths on the hard science pole, and their weaknesses on the verbal pole. Those opting for vocations classified as OCS, OBO, OHC, and OPL had their strengths on the verbal pole, and their relative weaknesses on the hard science pole. Only those opting for occupations classified as OAF had specific strengths in biology, but this pattern only appeared for test scores. For the groups of students classified as belonging to the vocational groups ONS and OTL, the profiles of test scores, grades, and self-

concepts w

constructs. Generally, the pattern of self-concept profiles was quite similar to test scores and grades, with the exception of self-concepts in the social domain. As previously mentioned, this domain is different, as it does not reflect a topic taught in school.

Group differences in the profiles of vocational interests followed a clear pattern. Students classified into the different vocational groups were, on average, characterized by high interests in the domains matching the most salient activities characteristic of the corresponding occupations, and were least interested in domains not relevant for the corresponding occupations. Students in the OPR and OCA groups had highest interests in the *R* domain and lowest in the *S* domain. Those in the ONS group had highest interests in the *I* domain and lowest interests in the *S* and *E* domains. Students in the OTL group had highest interests in the *E* domain. Those opting for occupations belonging to the OCS group had highest interests in the *S* and *E* domains and disliked *R*- and *I*-typed activities. Students opting for vocations classified as OBO preferred *C*-typed activities and disliked activities in the *R* domain. Those in the OHC group had their major interests in the *S* domain and scored lowest in the *R* domain. Students in the OPL group had their highest interests in the *A* domain. The students who opted for vocations classified as OAF showed, on average, a relatively flat interest profile.

3.2. Prediction of students' decisions to enter specific fields of VET

We now turn to the results of the analyses that addressed the relative predictive power of the sets of variables under study for students' decisions to enroll in different types of VET. In this section, we report the results obtained from multinomial logit models in which different sets of variables were used to predict vocational choices. To this end, we examine hit rates (i.e., the percentage of correctly classified individuals) as a function of the sets of constructs used as predictors (i.e., gender, achievement test scores, school grades, self-concepts, and vocational interests). Table 4 presents the hit rates that were obtained when each set of constructs was considered in isolation. The pattern of results closely resembles the pattern presented in Table 3. Table 4 also includes the hit rates derived from a series of models consisting of different sets of constructs. We started with the variables assumed to be the most distal predictors of vocational choices in the SCCT and the EVT, namely gender and test scores (Hypotheses 3 and 6). As shown in Table 4, these variables already result in a large number of correct classifications, ranging from 31.9% in the SOC to 48.5% in the RIASEC taxonomy. In the next step, the models were extended to include the next proximal set of predictors, namely, school grades. This resulted in a modest increase in hit rates across all classifications of vocational choices (1.6% to 3.2%). Adding self-concepts in the subsequent step of the analyses led to an increase of similar magnitude in hit rates (2.1% to 3.9%), whereas the inclusion of vocational interests resulted in the largest increases in hit rates irrespective of the classification system used (GCO: 7.6%; SOC: 8.9%; RIASEC: 7.1%). These results are largely in line with Hypotheses 3 and 6 stating that vocational interests are the most powerful predictors of students' vocational choices. However, in contrast to Hypothesis 3, we did not find indication for a practically relevant incremental effect of self-concepts over and above vocational interests.

Table 4. Results of multinomial logit models predicting vocational choices by different sets of constructs. Hit rates (% correct classifications) given by separate sets of constructs (gender, test scores, school grades, and vocational interests), and by multiple sets of constructs (in parentheses), as well as *p*-values (derived by Wald-χ^2-tests) for the contribution of sets of constructs in the full model, including all variables.

	GCO		SOC		RI
	Hit rates (%)	Contribution to full model	Hit rates (%)	Contribution to full model	Hit rates (%)

Base rate	Hit rates (%)		Contribution to full model	Hit rates (%)		Contribution to full model	Hit rates (%)	
G	39.2%		.003	31.3%		< .001	47.2%	
TS (+ G)	37.0%	40.2%	.043	29.1%	31.9%	< .001	43.6%	48.5%
	Separate	Combined	p	Separate	Combined	p	Separate	Comb
GR (+ G + TS)	37.2%	43.4%	.011	27.6%	33.5%	< .001	42.5%	50.5%
SC (+ G + TS + GR)	43.2%	46.1%	.044	32.4%	35.6%	< .001	51.6%	54.4%
INT (+ G + TS + GR + SC)	49.8%	53.7%	< .001	39.8%	44.5%	< .001	58.5%	61.5%

Notes: GCO = classification of vocations according to the German Classification of Occupations, SOC = classification of vocations according to the Standard Classification of Occupations, RIASEC = classification of vocations according to the RIASEC taxonomy, G = gender, TS = test scores, GR = school grades, SC = self-concepts, INT = vocational interests.

The hit rates obtained by using only vocational interests as predictors are remarkably close to the results provided by the most comprehensive models in which all explanatory variables were included. Therefore, it can be concluded that adding gender, test scores, school grades, and self-concepts (19 variables in total) to vocational interests increased hit rates by only 3.0% in the case of the RIASEC taxonomy and by 4.7% in the case of the SOC (GCO: 3.9%). Although these increases in hit rates appear to be modest from a practical point of view, the different sets of variables nevertheless had statistically significant effects in most cases, as judged by the Wald-χ^2 tests of multiple parameter constraints. Remarkably, the fewest significant contributions to the overall model were found when the vocational choices were classified according to the RIASEC taxonomy: here, only vocational interests and self-concepts had statistically significant effects. This finding is in line with our expectation that coding vocational choices by means of the RIASEC taxonomy "punishes" variables that are relatively weakly linked to vocational interests.

4. Discussion

The present study examined the role of gender, school achievement tests, school grades, self-concepts, and vocational interests in predicting the vocational choices of 10th-grade students facing the transition from school to VET. Our study is unique in many respects. First, it used a large sample of adolescents facing a normative transition. Second, it considered a broad array of constructs assumed to underlie vocational choices (Eccles, 2009, Holland, 1997, Lent et al., 1994, Marsh and Yeung, 1997, Sheu et al., 2010). Third, the sets of constructs considered were assessed with respect to multiple domains reflecting the world of work and the school curriculum. Thereby, they accounted for the role of individuals' profiles of domain-specific variables, including their strengths and weaknesses as well as their likes and dislikes. Fourth, we considered alternative classification systems for coding students' vocational choices. Specifically, we considered systems that are based on the characteristics of the labor market (the GCO and SOC), and also categorized vocational choices on the basis of the RIASEC taxonomy. We believe that this is an important point because, depending on the classification system used, the role that certain sets of constructs play in the prediction of vocational choices may be overestimated.

Overall, the results support most of our expectations. The pattern of empirical correlations of self-concepts, test scores, and school grades with vocational interests indicated systematic relationships between curricular domains and the RIASEC categories. In addition, we found associations between all sets of variables under study. Remarkably, vocational interests appeared to be most systematically linked to all sets of constructs considered.

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vocational interests were most closely linked to gender (36% common variance). The relationships between the remaining sets of constructs were generally in line with previous research (Fouad and Smith, 1996, Nagy et al., 2006). Of the motivational constructs, self-concepts were most closely linked to achievement (test scores and grades), and vocational interests were most closely linked to self-concepts.

All sets of constructs were related to students' vocational choices. Vocational interests had the strongest relationships, followed by self-concepts. Gender, test scores, and school grades showed weaker relationships of similar size. These findings are in line with research showing that interests are the most powerful determinants of educational and occupational choices (e.g., Navarro et al., 2007, Päßler and Hell, 2012). Moreover, a close inspection of the mean profiles of test scores, school grades, self-concepts, and vocational interests revealed that students tend to choose occupations for which they appear to be well equipped (Holland, 1997, Lent et al., 1994, Patrick et al., 2011, Päßler and Hell, 2012, Tracey and Hopkins, 2001).

Regarding the prediction of adolescents' vocational choices, we found that all sets of variables were significantly related to adolescents' vocational choices regardless of the classification system used to code their choices. However, for each occupation classification system, we found that the hit rates provided by vocational interests alone were remarkably close to the hit rates obtained when all 25 predictor variables were simultaneously considered. Hence, our research suggests that the profiles of vocational interests are the key driving forces behind adolescents' vocational choices, meaning that students make their vocational decisions on the basis of their likes and dislikes. As vocational interest profiles are strongly related to other sets of constructs, differences between vocational groups in their profiles of test scores, school grades, and self-concepts, as well as group differences in gender composition, appear likely to be the consequences of self-selection processes driven by vocational interests. In other words, the fact that vocational choices are based on vocational interests could be sufficient in explaining differences in many characteristics found between members of various vocations. This interpretation is supported by our finding that achievement indicators, self-concepts, and gender show a negligible incremental predictive value over and above vocational interests, although they are systematically related to students' vocational choices.

4.1. Integrating construct profiles into theories of vocational choices

A unique feature of the present investigation is the assessment of a diverse array of domain-specific constructs. More specifically, the measures used approximated the profiles of adolescents' objective (test scores), ascribed (grades), and self-perceived (self-concepts) strengths and weaknesses, as well as their likes and dislikes (vocational interests). Profiles are normally considered in investigations of vocational interests (Nagy et al., 2012, Volodina et al., 2015b), and studies based on the IE model also examine at least some of students' self-concept profiles (Marsh et al., 2015). The present research highlights the merits of a more detailed assessment of the profiles of achievement-related constructs. It also makes it possible to investigate the relationships of students' strengths and weaknesses with vocational choices.

Remarkably, the relationships between the profiles of students' achievement-related constructs and their vocational choices appeared to reflect the distinction between two opposite poles. The first pole is characterized by mathematics- and technically-typed domains (hard sciences), whereas the second pole is characterized by verbal domains (German and English). Although these results are purely descriptive, they correspond to a bipolar structure supposed to underlie students' academic self-concepts (Marsh, 2007) and their objectively assessed abilities (Nagy et al., 2012). In research suggesting this bipolar structure, the domains of biology and economics occupy an interim position located between the poles. With very few exceptions (e.g., OAF vocations in the GCO), we did not find any vocational groups with specific strengths located between the two poles.

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the EVT (Eccles, 2009). As we considered the sets of constructs assessed with respect to many domains, whereas most other applications of the SCCT or the EVT have considered only a single domain, or at best two domains in which the constructs were assessed (e.g., Garriott et al., 2013, Guo et al., 2015, Nagy et al., 2006, Parker et al., 2012), our analyses provide a powerful test of the key assumptions of both theories. Our findings are largely in line with the predictions of the SCCT and the EVT, showing that interests (i.e., intrinsic values in terms of the EVT) are the most proximal predictors of students' vocational choices. However, in contrast to previous studies (e.g., Nagy et al., 2006, Parker et al., 2012, Sheu et al., 2010), we were not able to confirm findings that have suggested that self-concepts (i.e., expectations of success in terms of the EVT) strongly predict students' choices over and above interests. Rather, our findings indicate that those findings could be due to a failure to carry out a more detailed assessment of interests.

Although we attempted to select self-concept domains related to the RIASEC taxonomy, it might nevertheless be argued that assessing self-concepts that fit perfectly to the RIASEC taxonomy could provide a different picture. This is an important issue for future research. Furthermore, as self-efficacy beliefs were not available in the present data set, it is possible that this construct has incremental effects on students' vocational choices over and above interest. Although we suggest that this issue be investigated in future studies, we are rather skeptical that it is the case because, although rooted in different research traditions, domain-specific self-concepts and self-efficacy beliefs tend to be strongly correlated (e.g., Marsh et al., 2004).

4.2. Practical implications

A large body of research suggests that vocational interests develop over the course of schooling and are relatively stable from age 14 on (e.g., Low, Yoon, Roberts, & Rounds, 2005). Our results therefore have potential implications for the design of interventions aimed at attracting specific groups of students to particular fields of VET (e.g., women to STEM fields of VET). Given the stability of the profiles of vocational interests, it does not seem likely that interventions that aim to change individuals' interests would be effective. Additionally, our research shows that it might not be enough to increase students' interests in one domain (e.g., *R* or *I*): In order to be effective, interventions also need to reduce adolescents' interests in competing domains (e.g., *A* and *S*) because they form their vocational preferences by simultaneously considering their likes (i.e., their highest interests) and their dislikes (i.e., their lowest interests). Such an endeavor not only appears to be unrealistic; it might also be questioned on ethical grounds.

An alternative way of increasing the number of students who choose particular vocations may be to emphasize particular aspects of specific vocations (e.g., *A* and *S* in STEM fields of VET). Hence, interventions might be designed to change adolescents' appraisals of the key elements of vocations. For example, the number of female students entering vocations in STEM might be increased by making social and creative types of activities more salient and, at the same time, putting less emphasis on the technical aspects of the occupations.

Taken together, our results underscore the validity of vocational counseling that is based on the counselees' interest profiles (e.g., Holland, 1997). Although our research provides strong evidence that the majority of adolescents make their vocational choices on the basis of their interest profiles, some individuals will always be less well informed about the opportunities available in and the requirements imposed by many occupations. Such individuals are at risk of entering vocational paths that are not congruent with their interest profiles, which makes those individuals more prone to negative experiences (e.g., Volodina, Nagy, & Köller, 2015).

4.3. Limitations and future research

As in all empirical studies, the present investigation has some limitations that should be taken into account when interpreting the results. First, we considered a specific sample drawn from one country (i.e., Germany). Hence,

the general

with many other studies (e.g., Nagy et al., 2012, Päßler and Hell, 2012, Sheu et al., 2010), we expect the results to be generalizable to other situations. Of course, the application of our design to other societies with a different structure of postschool education (e.g., Great Britain) would be very interesting (e.g., Parker et al., 2012). Second, our study was cross-sectional. Given the limits of cross-sectional data, it seems important to conduct longitudinal studies in the future to better capture the interplay between the variables under study over time. Third, as we have already mentioned, measures of self-efficacy beliefs were not available in the present study, even though these constructs are at the core of the SCCT. Future studies should therefore include domain-specific measures of self-efficacy beliefs alongside self-concepts. Fourth, we focused on the students' desired field of VET, without considering the field of VET that students actually entered. The authors of the SCCT suggest that measures of vocational aspirations, expressed plans and choices are conceptually distinct from actual career-related actions (Lent et al., 1994). However, although we agree with these arguments, the vocational aspirations considered in the SCCT appear to refer to aspirations assessed far before the postschool transition takes place. Furthermore, previous research has found individual aspirations to be highly predictive of realized occupational choices (e.g., Schoon et al., 2007). In addition, we were able to replicate the findings we reported by considering the fields of VET that students had already applied to, i.e., with an outcome reflecting real career-related choice behavior in terms of the SCCT (results available upon request). Hence, we do not consider this point to be a main concern in the present study.

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Week 3

Kids who Struggle