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# ”The Norwegian Jackson Vocational Interest Survey: Translation, cultural adaptation and preliminary psychometric evaluation”

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## Abstract

The ipsative American vocational interest inventory Jackson Vocational Interest Survey (the JVIS) was translated to Norwegian and tested in the sample of 484 Norwegian students at the Norwegian University of Science and Technology. Seventeen bipolar components appeared in the subsequent principal component analyses. Those components constituted 19 meaningful scales, which were generally similar to the American equivalents. All scales seemed to have good face validity and high ordinal reliabilities, $\alpha_{alpha} > .70$.

Additional analyses focused on the concurrent validity of the Norwegian version of the test in the six student groups: Social Science, Medical Science, the Humanities, Natural Science and Mathematics, Engineering and Technology, and Teacher Education. Only the JVIS scales that reflected vocational interests within the six fields of study were selected for those analyses. Firstly, one-way ANOVAs were used to test mean differences in vocational interests, measured by the selected JVIS scales, across the six student groups. For that matter, the *post hoc* paired comparisons revealed that the majority of the JVIS mean scores were significantly highest for the expected student groups. Secondly, the relationship between vocational interests and student satisfaction measures (i.e. Academic Satisfaction and Social Satisfaction) was explored using correlational analyses. The results revealed significantly positive correlations only between few of the selected JVIS scales and Academic Satisfaction. The relationship between Social Satisfaction and the JVIS vocational interest scales was significantly positive in one case, and significantly negative in two cases.

The final t-test analyses focused on sex differences in vocational interests. The results indicated the existence of sex disparities reflecting, to a certain extent, traditional male and female preferences with the effect sizes from small to moderate.

Several limitations of the study, the biggest of which was the forced-choice format of the JVIS, were discussed. Furthermore a number of recommendations for further research and career counselling were presented, based on the discussed theory, empirical studies, and the results of the current research.

## Preface

It was my supervisor Karin Laumann who gave me the idea of Norwegian translation and adaptation of the Jackson Vocational Interest Survey. She mentioned the inventory in one of her lectures. Thus the study was not a part of any bigger research project. The translation was done by me, and verified by my supervisor and another Norwegian native speaker. I developed hypotheses, collected data, and conducted all the analyses. All necessary permissions to translate the inventory and conduct the main study in the student population at the NTNU were obtained before the data collection.

Exploring the structure of the Jackson Vocational Interest Survey was an interesting, challenging, informative, and at times very frustrating task. Now, at the end of my ″ journey″, I have a strange feeling of melancholy. Suddenly, it seems difficult to abandon the world of vocational interests, statistical analyses (where tetrachoric correlations have become my very ″favourites″), and career counselling. On the positive side, I have at least time to thank several people for their support in the whole process of working with this thesis.

First of all, I would like to thank my supervisor Karin Laumann for all expert advises, suggestions and instructions, and for the help with the translation.

I also wish to thank Kyrre Svarva for technical support in constructing the survey, and Sharon Van Duynhoven from SIGMA Assessment Systems who helped me with formal issues regarding the use and translation of the test. I also thank my friend Jørn Olav Løkken and my very best Eiliv Brenner for taking their time proofreading the thesis, and my work colleagues at the NT-faculty, who made it possible for me to complete the thesis while working on a part-time basis.

I also need to give credit to all student advisors, student representatives and student organizations that helped me in recruiting respondents. Without their help, the results would have amounted to ″a non-positive definite matrix″.

Finally, there is one small creature that deserves my appreciation for always patiently sitting right by my side, and never getting tired of me reading, conducting analyses and trying to put my thoughts on paper. That very creature is my cat.

# Contents

## Abbreviations

**A-component/ A-scale** – component/scale represented by an A-pole (left pole) in a bipolar component

**B-component/ B-scale** – component/scale represented by an B-pole (right pole) in a bipolar component

**ANOVA** – analysis of variance

**FA** – Factor analysis

**JVIS** – Jackson Vocational Interest Survey

**NTNU** - Norwegian University of Science and Technology

**PCA** – Principal component analysis

**P–E fit** - Person–environment fit

**RIASEC** – the six vocational personality types in Holland's theory: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (Holland, 1973, 1985, 1997)

**$R_t$-matrix** – matrix of tetrachoric correlations

**When they asked me what I wanted to be I said I didn't know.**
**″Oh, sure you know, ″ [they] said.**
**″She wants, ″ [he] said wittily, ″to be *everything*.″**

Silvia Plath ″The Bell Jar″

## Introduction

Work is integral to human functioning. Ninety-six percent of Norwegians state that, next to home and family, having a job is the most important aspect of their lives (Helsedirektoratet, 2011). Compared to employed individuals, the unemployed are significantly more likely to experience lower psychological well-being and worse physiological health (see e.g. McKee-Ryan, Song, Wanberg, & Kinicki, 2005; Murphy & Athanasou, 1999; Wanberg, 2012). Hence it is not surprising that many people will go to great lengths to get a job. However, finding a job is often not a straightforward task. For many individuals, possible job options are not clearly defined, and they will often seek guidance to actualize them. Other people are very confident of what careers will match their interests abilities and aspirations, but even they might one day need help to reconsider their expectations and ambitions, and make more pragmatic educational or occupational choices. Still others, who want to be ″everything″, may need advice on how to narrow down possible options.

There are many factors that can influence career choices and career development, for instance, abilities, intelligence, socioeconomic status, gender, interests, and cultural background (Furnham, 2005). There are also many different methods that can be used to help people to find the most suitable academic majors and occupations. It will demand many pages to explore all the possible factors that can influence people's career choices or to discuss different methods used in vocational counselling. To narrow down possible alternatives, I have decided to focus on vocational interests, even though some other psychological concepts, such as personality and aptitudes, will also be discussed.

Vocational interests play an important role in career development and career counselling. Norwegian students often state that their educational or vocational choices are dictated by their own interests (Schreiner, 2006, 2008; Ramberg, 2006). Researchers also agree that interest measures may be important and valid factors for prediction of job-relevant behaviours and intentions (Van Iddekinge, Putka, and Campbell, 2011). Indeed, it is difficult to imagine a vocational counselling situation which does not involve asking the questions: What are you interested in? What kind of job would you prefer to have?

My approach to vocational interests has mainly a statistical and operational character. It is because I have focused on translating and testing the validity and reliability of a popular American vocational interest inventory the Jackson Vocational Interest Survey (the JVIS as it will be called from now on) in a student population at one of the biggest universities in Norway. In addition, I have explored several hypotheses regarding the relevance of vocational interests measured by the translated JVIS for different outcomes: student group affiliation and student satisfaction in the six different student groups (i.e. Social Science, Medical Science, the Humanities, Natural Science and Mathematics, Engineering and Technology, and Teacher Education), and gender differences.

As signalized before, the importance of work has been recognized in psychology for a long time. Psychologists have devoted many pages to understanding the role of work in people's lives. There are specialties and proficiencies in psychology which are entirely devoted to the scientific study of work life. Work and organizational psychology is a central field in that respect. The current study focuses on vocational interests as an important aspect of vocational choice and career development, and on measurement of vocational interests as an essential part of career counselling. Thus the topic seems well grounded in work psychology. Specifically, it draws inspiration from one of many branches of work psychology, which is known as vocational psychology. Vocational psychology is in fact one of the oldest and the most controversial areas of applied psychology (Furnham, 2005; Silvia, 2006; Tinsley, 2001).

Exploring the world of vocational psychology and greater understanding of the importance of educational and occupational choice, even though just through the prism of vocational interests and their assessment, seems to be especially important nowadays. Vocational psychology is on a verge of major transitions due to rapid changes in the world of work, for example, increasing work force mobility, greater multiculturalism in workplaces or growing educational attainment (Fouad, 2006). Finding a job no longer refers to a single choice made early in life, but to a series of choices or forced transitions made over a life span (Fouad, 2006). Consequently, the issue of helping people to make realistic and reasonable educational or occupational choices becomes more and more important. Not everybody can get ″a dream job″, and for many ″a career choice″ may even be a totally abstract and oxymoronic phrase. Still, qualified counsellors and vocational psychologists can guide individuals to make suitable career choices, through exploration of personal goals, abilities, values and interests (Fiske & Berge, 2011; Furnham, 2005). The level of competence of vocational advisors is without a doubt crucial for successful counselling. The effective career

guidance is also dependent on good counselling tools, such as vocational interest inventories. However, only reliable and valid vocational interest measures can contribute to more trustworthy and informed vocational counselling. The present study is an initial attempt to adjust this kind of instrument to Norwegian conditions.

Psychologists put much effort into exploring, categorizing and measuring interests. One of the central features of vocational psychology is trying to establish reliably and validly vocational interests of individuals and recommend jobs that match those interests (Furnham, 2005; Silvia, 2006; Savickas, 1999). Generally, this is how vocational interest inventories are ″born″. A quick search with Google for interest inventories gives hundreds of hits. The purpose of the present thesis is neither to give a full overview or a detailed description of available interest inventories on the American or Norwegian work and counselling market, nor indicate which inventories are good, and which are poor. However, it is important to be aware of the variety of the choices in that matter. The JVIS will be reviewed in detail in the Theory section. Some of the other most popular interest inventories available in English, for example, the Strong Interest Inventory or the Kuder Occupational Interest Survey, will also shortly be presented. Additionally, some of the apparently most known Norwegian interest tests will be mentioned.

The industry of vocational interest inventories in the USA is huge. It should indeed be called an industry, as new interest measurement tools seem to appear all the time. Taking into consideration that thousands of people take vocational interest tests every year (Silvia, 2006), this is not surprising. Sigma Assessment Systems which is the owner of the JVIS states on its website that over 600,000 people have received JVIS reports. The number is possibly lower in case of Norwegian interest inventories, but a Google search for any statistics that will give an approximate number has been unsuccessful. Nevertheless, visits to websites of different Norwegian career centers and career services shows that many of them has a vocational interest inventory on its ″menu″. For example, the Norwegian Labor and Welfare Administration (NAV) has published several different interest inventories on its website (e.g. *Interessetesten* and *Veivalg*). Management Synergy AS administers and offers certification in *Solbergs interessetest* as a part of internet based career-planning system *Profråd*, under the auspices of the Norwegian University of Science and Technology.

The biggest problem related to the whole American interest test industry is that only few of those tests have been proven useful through scientific testing (Silvia, 2006; Savickas, 1999). In fact, of the dozens of American vocational interest inventories, only a very small number is used for non-commercial research (Silvia, 2006). The JVIS appears to be one

among those few. A Google Scholar search for scientific articles that at least mention any of the popular Norwegian interest inventories has proven largely fruitless.

None of the most popular and widely validated American interest inventories have been translated to Norwegian. I have used the word ″apparently″ above, because the whole ″business″ of vocational interest inventories is very little transparent, most probably because of its commercial value. It is therefore very difficult to get a whole picture of what kind of interest inventories are available on the Norwegian market, and even more importantly, to determine if and how valid and reliable they in reality are. The present study seems therefore in many ways innovative. The lack of transparency in the Norwegian research on vocational interests and their assessments makes the topic of studying, translating, validating, and discussing the JVIS, which is regarded as a valid and reliable tool for measuring vocational interests, even more relevant (see Jackson, 2000; Jigău, 2007; Murphy & Davidshofer, 2005; Su, Rounds, & Armstrong, 2009). The scientific approach to interest inventories presented in the current thesis also highlights the importance of using valid and reliable instruments to measure vocational interests. One of the most important objectives of my study is to encourage career advisors to be critical about tools available on the market, and vocational researchers to develop vocational interest inventories by means of proven scientific methods.

The purpose of my thesis is to find answers to the four questions. I expect that Norwegian version of the JVIS will include similar scales to those of the American inventory. Thus I will focus on the following question: *Will the structure of the Norwegian version of the inventory resemble that of the original JVIS*? Moreover, owing to fact that the inventory has been tested in the population of Norwegian students, the following two questions seem valid: *Can the JVIS scores be used to differentiate between vocational interests of students majoring in different fields of study*? *Are scores on the JVIS scales related to satisfaction with academic and social environment for a particular student group*? The answer to both questions will help to determine the criterion validity (see Field, 2013) of the translated JVIS. Finally, I have also decided to explore gender differences in vocational interests and find an answer to the following question: *Are there sex differences in vocational interests measured by the Norwegian version of the inventory*?

Before I go on to present theories, studies, and important findings related to the present study, there is one additional question that deserves an answer here and now: Why focusing on the JVIS? As described before, it looks like vocational interest assessment is neglected in the psychological research in Norway. Any attempt to change this situation seems worth one's time and trouble. Since I also want to focus on an inventory that has been

widely tested and used in research, the JVIS seems like a proper choice (see e.g. Jackson, 2000, for a full research overview). Moreover, many tests cannot be administered without a certification (which of course cost money), so again the JVIS, which is easy to administer and require a Bachelor's degree in psychology, is in many ways perfect for the purpose of my study. Finally, I have wanted to challenge myself by working with a controversial ipsative format, and the JVIS is indeed an ipsative inventory. For each pair of 289 statements describing various job-related activities, the respondents are asked to choose the one that matches their interests.

The thesis consists of four main parts. The purpose of the first theoretical part is to give the reader a general insight into the psychology of interest, a more detailed description of theories of vocational interests, an elaborate illustration of the JVIS itself, and a critical look at the methodological issues that should be taken into consideration before conducting the main analyses. Psychological literature on interests is rich in theories, models and perspectives which seem to both contradict and supplement one another (see Silvia, 2006 for a detailed overview). There is of course not enough space in the current thesis to review them all. Nor is the main purpose to present all possible views of interests that exist in psychological research. However, starting with a general overview of how psychologists understand and study interests, the reader will be ″taken on a journey″ through different definitions of vocational interests, various models describing vocational interest structure, among which Holland's hexagon is the most influential one, through studies of how vocational interests relate to personality and abilities, the research on gender differences in vocational interests, and through a detailed description of psychometrical properties of the JVIS. The final part of the Theory section will deal with the problems of ipsative measures.

Methodological aspects of the study relating, among others, to the translation of the inventory, the sampling procedure, and the description of the variables used in the analyses, will be dealt with in the Method section. The subsequent Results part of the thesis will naturally focus on the presentation of the results of all the analyses conducted in the current study. I will come back to the main findings in the last Discussion part, where all the important issues relating to validation of the JVIS and testing of the hypotheses will be deliberated on the basis of the described theories, empirical studies, and methodology. Limitations and strengths of the present study will be discussed as well. Moreover, I will make an attempt to give some suggestions for future research on vocational interests, and their assessment, but most importantly, for future Norwegian studies of the JVIS. Recommendations for vocational counselling will be discussed too.

# Theory

## A brief overview of the psychology of interest

Psychology's interest in interest goes a long way back to the beginning of the 20th century when educational psychologists Arnold (1910) and Dewey (1913) argued for the effect of interest on attention in the educational processes. Today, there are many different psychological approaches to interest that may not seem very consistent with one another. In his comprehensive book on interest studies in the wide-ranging areas of psychology, Silvia (2006) divides interest literature into two fields: interest as a part of emotional experience and interest as a part of personality. The author refers to both perspectives with the simple terms *interest* and *interests.* The former concept, often described as *situational interest*, indicates the spontaneous and context-specific emotional state of momentary motivation and curiosity (see Schraw & Lehman, 2011, for a research overview). Researchers operate in the realm of emotion and cognitive psychology. They study facial movements and responses as interest-associated behaviours (Reeve, 1993), the benefits of interest-promoting stimuli (e.g. seductive and explanatory information) for learning (Harp & Mayer, 1997), the effect of task interest on performance (Fisher & Noble, 2004), the feelings of interest triggered by aesthetically pleasing stimuli (e.g. Silvia, 2005a), or the cognitive processes that cause interest (Silvia, 2005b).

The latter term reflects more stable and enduring psychological structures. Psychologists focus on traits related to interests such as openness to experience (McCrae, 1996), proneness to boredom (Farmer & Sundberg, 1986), or motivational and emotional aspects of human curiosity (Berlyne, 1954a, 1954b; Kashdan, Rose, & Fincham, 2004). Moreover, a large body of literature on the dispositional nature of interests has been concerned with the structure and the development of vocational interests, their influence on career decision making, and their application in vocational counselling (Holland, 1997, 1985, 1997; Savickas & Spokane, 1999; Silvia, 2006). The current study is naturally inspired by this last mentioned approach, since it deals with the structure and assessment of vocational interests in the light of the popular interest inventory – the JVIS.

## Vocational interests

Vocational psychologists have been convinced about the importance of interests for better career and educational plans for a long time (see Savickas, 1999, for a historical overview). Surprisingly, despite the overwhelming scientific focus on vocational interests,

the concept lacks a universal and consistent definition (Savickas, 1999: Silvia, 2006). A vast amount of empirical studies of vocational interests have generally failed to define the unique aspects of vocational interests and address differences between them and other motivational constructs (Savickas, 1999). The fact that the research on vocational interests has generally examined the construction, validation, and interpretation of various vocational scales, is probably the main reason for that particular state of affairs (Savickas, 1999). Hence vocational psychologists concentrated mostly on the production and usefulness of interest inventories, and operational rather than theory-based explanations of vocational interests. Nevertheless, some ideas have had more influence on the interpretation of vocational interests than others. Those ides will get a short review in the respective Theory subsections.

**Strong's and Kuder's inventoried interests**

Originally, vocational interests had diffuse connotations, but nevertheless were universal concepts, embedded in the theoretical psychology of motivation and behaviour (Spokane & Decker, 1999). The introduction of the indirect measurement of vocational interests, that is, the Strong Vocational Interest Blank (Strong, 1927, as cited in Spokane & Decker, 1999), and subsequently also the Kuder Preference Record (Murphy & Davidshofer, 2005), portended a paradigm shift in that matter (Spokane & Decker, 1999).

According to Strong (1955), vocational interests could be regarded as a set of activities which were liked, indifferent or disliked. Realization of interests was an active process:

> Interests are then activities for which we have liking and disliking and which we go toward or away from […] furthermore, they may not be preferred to other interests and they may continue over varying intervals of time. Or an interest may be defined as a liking/disliking state of mind accompanying the doing of an activity, or the thought for performing the activity (Strong, 1955, p. 138).

Strong (1955) noticed that members of specific professions were systematically different in their *likes and dislikes*, and that the pattern of interests was quite stable from adolescence throughout a lifetime.

Strong based his interest inventory on the assumption that vocational interests could be measured by contrasting the score pattern on different vocational interest scales of a specific occupational group with that of a ″people-in-general″ reference group. As a result, he administered the inventory to people in various occupations in order to identify items that were significantly preferred more or less often by a specific work group rather than a non-

specific group (Campbell, 1971; Murphy & Davidshofer, 2005). His inventory consisted of those identified items.

The Strong Vocational Interest Blank, as well as its most modern version the Strong Interest Inventory, includes a list of several items a respondent are asked to rate on a 3-point scale: *Like*, *Indifferent* and *Dislike* (Campbell, 1971; Murphy & Davidshofer, 2005). Specific information about likes and dislikes of the respondents is reflected by the homogenous basic interest scales which focus on narrow vocational interest areas. In fact, many of those scales laid the foundations for the development of the JVIS basic scales (Jackson, 2000).

Kuder took a very similar approach to vocational interests when he published the Kuder Preference Record in 1944 (Murphy & Davidshofer, 2005). Kuder defined and scaled vocational interests as manifestation of vocational *preferences for specific activities and behaviours* (Murphy & Davidshofer, 2005; Mosier & Kuder, 1949). In line with Strong's theory, he observed that there was a degree of congruence between interest patterns of individuals belonging to specific occupational groups (Mosier & Kuder, 1949). However, unlike Strong, he regarded all items that were initially selected by members of a criterion occupational group as important, and not only the statements that significantly differentiated a criterion group from a reference group. He also believed in the superiority of ipsative interest measures. The most recent Kuder Occupational Interest Survey is based on a forced-choice item format. Respondents are asked to choose the most preferred, and the least preferred activity out of three possible alternatives (Murphy & Davidshofer, 2005).

Following Strong's and Kuder's inventions, vocational interests became but scores on interest inventories (Crites, 1999). These so-called inventoried interests indicate the degree of similarity of item response pattern between a respondent and an identified norm group (Darley, 1938; Spokane & Decker, 1999). Inventoried interests are treated as patterns of likes and dislikes regarding job-related activities and occupations (see e.g. Lent, Brown, and Hackett, 1994, p. 88). Savickas (1999) warns against these kinds of specific, indirect, operational rather than conceptual definitions which fail to capture the real psychological nature of interests (i.e. their cognitive, emotional, motivational or behavioral aspects; see Savickas, 1999, pp. 50–51, for an overview).

The more ″up-to-date″ definitions are somehow less operational, as they more often take different aspects of vocational interests into consideration, not only their inventoried nature. They also seem to summarize a myriad of definitions produced over the years. For instance, Mount, Barrick, Scullen, and Rounds (2005, p. 449) define interests as ″long-term dispositional traits inherent in the person that influence behavior primarily through one's

preferences for certain environments, activities, and types of people." Van Iddekinge et al. (2011, p. 14) talk about "relatively stable individual differences that influence behavior through preferences for certain work activities and work environments".

**Measured versus expressed interests**

Spokane and Decker (1999) underline an important distinction between measured and expressed interests. Measured interests refer to the empirically keyed scores obtained by means of a reliable and valid interest inventory. On the other side, expressed interests are based on self-expressions of interests, and usually involve daydream items or direct and open questions about people's present and desired job situation, for example: "What is your occupation?", "What kind of job would you like to have after you graduate?" Despite a long agreement that direct questions had been inferior to the sophisticated criterion-based scaling methods, researchers demonstrated that direct measures could be more valid, even if less reliable, than indirect inquiries (Borgen & Seling, 1978; Dolliver, 1969; Spokane & Decker, 1999). Those researchers also pointed out that expressing interests was a complex process that involved conscious evaluation of many additional factors (e.g. family situation, experience, cultural background) (Borgen & Seling, 1978; Crites, 1999; Dolliver, 1969; Spokane & Decker, 1999). Thus the measurement of vocational interests could not entirely be reduced to a simple and an unsophisticated statement of liking, signalized by a tick next to the most preferred item on the vocational interest test (Crites, 1999). Consequently, Spokane and Decker (1999) as well as Hartung (1999) have argued for both measured and expressed interests as an important property of vocational interest inventories.

**Personality and vocational interests**

Strong's view of vocational interests as activities that are liked or disliked have had a great impact on how interests have been understood and measured. Other researchers suggested that interests were very closely related to personality (see e.g. Costa, McCrae, & Holland, 1984). In 1949, Super postulated that the origin and development of interests as stable personality traits and dispositions that influenced behaviour. The definitions of vocational interests that focus on the stability of their patterns and their impact on behaviour, resembles those provided for personality. For example, McCrae and Costa (1989, 1997), and Østbø and Nordvik (2008) showed that personality could be classified into five dimensions comprising different universal discrete traits and encompassing enduring emotional, experiential, attitudinal, and motivational patterns that explained behaviour in different

situations (the Big Five personality model, McCrea & Costa, 1997). The five higher-order personality dimensions are Extroversion (sociability, activity, and predisposition to experience positive emotions), Neuroticism (tendency to experience negative emotions such as anxiety, anger, depression), Openness to Experience (imaginativeness, aesthetic sensitivity, and curiosity) Agreeableness (sympathy, trust, cooperation, and altruism), and Conscientiousness (persistence, scrupulousness, and need for achievement) (McCrae & Costa, 1989; Østbø & Nordvik, 2008).

**Holland's theory of vocational personality types**

The view of vocational interests and personality as very similar entities was strongly advocated by one of the most prominent and influential vocational psychologists John Holland. His theory is different from other systematic views of vocational interests in that it explicitly acknowledges the role of personality. According to Holland (1973, p. 7), ″a person's vocational interests flow from his life history and his personality [and] […] are simply another aspects of personality″. Consequently, interest inventories should also be treated as personality inventories (Holland, 1999). People in different occupational groups have similar personalities and similar histories of personal development. They tend to show similar behaviour in many situations, as well as a similar response pattern to different problems (Holland, 1973, 1985, 1997). Holland (1973, 1985, 1997) assumed that vocational interests could be classified into six vocational personality types and six parallel environments: *Realistic*, *Investigative*, *Artistic*, *Social*, *Enterprising*, and *Conventional* (the RIASEC classification, se Holland, 1997, pp. 21–28 for detailed and most recent descriptions; all the types will be denoted by capital letters from now on). Each type comprises similar experiences, dispositions, behaviours, values, beliefs, preferences, and most importantly vocational interests.

Realistic individuals enjoy physical and machine-oriented work activities. They are interested in working with concrete things and finding practical solutions to the problems. Possible realistic occupations are thus electrician and mechanic. Investigative people value logic and learning. They prefer scholarly and intellectual job-related activities which involve working with mathematics, technology and other types of sciences. Scientific jobs (e.g. researcher) fit well into the Investigative type. Individuals classified as Artistic types value self-expression through creative and performing art methods such as dancing, acting, painting or composing. An Artistic person prefers ambiguous, free and unsystematized activities. People with Social interest enjoy activities that give a possibility of interacting with others.

They tend to show a strong affinity for jobs that involve teaching, helping, informing, treating or training others. Social worker, teacher or counsellor are examples of common careers for Social types. Enterprising individuals develop a preference for work activities that include the manipulation of others as a means of personal or organizational success. Individuals categorized as Enterprising tend to enjoy leadership, supervision, sales and business activities. People with Conventional interests prefer routine work activities. They perceive themselves as orderly, organized and reliable and as having good numerical and clerical abilities. Office occupations (e.g. accounting) may appeal to Conventional individuals (Holland, 1973, 1985, 1997).

**Holland's RIASEC hexagonal model**

Holland's RIASEC model has attracted more attention in vocational research and literature than any other vocational concepts (Furnham, 2001). It has also served as a framework for different psychological constructs and individual differences (see e.g. Armstrong, Day, McVay, & Rounds, 2008). It seems in fact almost impossible to discuss vocational interests or work with vocational interest inventories without referring to Holland's model.

Holland (1973, 1985, 1997) argued that the six RIASEC types form a symmetric spatial configuration that resembles a hexagon (Cole, Whitney, & Holland, 1971; Holland, Whitney, Cole, & Richards, 1969). Types that are allocated close to each other are more similar than the types on the opposite side of the hexagon (see Figure 1). For example, people who score highest on the Realistic type will be expected to have a high score on the adjacent dimensions (i.e. Conventional and Investigative), a lower score on the alternate types (i.e. Enterprising and Artistic), and the lowest on the opposite Social interest. The hexagonal structure is robust (Silvia, 2006). It emerges in several different interest inventories, many of which have actually adopted Holland's typology to organize the results (Savickas, Taber, & Spokane, 2002). It has been replicated in different cultures, although it appears to fit better for some contexts than for others (e.g. Day & Rounds, 1998, Einarsdóttir, Rounds, Ægisdóttir, & Gerstein, 2002; Ferreira & Hood, 1995; Nordvik, 1991b; Tak, 2004; Tracey, Watanabe, & Schneider, 1997).

Holland's theory represents the conceptual background of one of the most popular interest inventories that aims at assessing a counsellee's career-related personality (Barak & Cohen, 2002; Jigău, 2007) – the Self-Directed Search (Holland, Fritzsche, & Powell, 1994, as cited in Silvia, 2006). The instrument allows counsellees to explore their vocational interests

and competencies on their own or with a counsellor. Counsellees' obtained profiles are compared to Holland's vocational personalities and specific occupations in order to find the best career match (Jigău, 2007). The inventory has a forced-choice format with lists of activities, occupations, self-estimates of abilities and competencies (Gottfredson & Holland, 1975; Jigău, 2007). Reponses referring to interests in activities and occupations, as well as to abilities and competencies yield a raw score for each of the RIASEC types (Jigău, 2007).

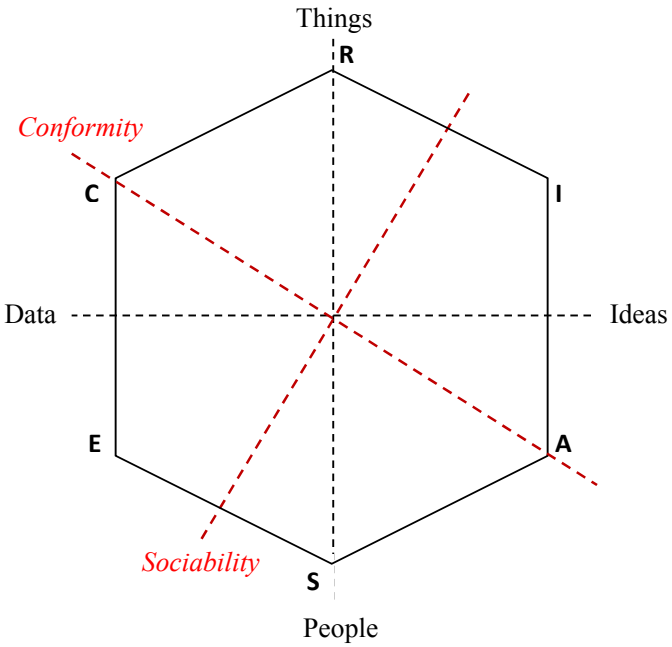


*Figure 1*. A schematic representation of Holland's vocational personality types (Holland, 1973, 1985, 1997), with Prediger's people versus things and data versus ideas dimensions (Prediger, 1982, 1996; Prediger and Vansickle, 1992), and Hogan's conformity and sociability dimensions (Hogan, 1983, as cited in Hogan & Blake, 1999). (R = Realistic; I = Investigative; A = Artistic; S = Social; E = Enterprising; C = Conventional).

**Personality and vocational interests revisited**

Holland's theory of vocational interests as an expression of personality emerged before the rise of modern typologies of personality structure (Silvia, 2006) such as the previously mentioned and currently the most influential five-factor model. Nevertheless, psychologists have long treated personality and interests as separate dispositional attributes that influence behaviour through motivational process, for example choices people make about which activities to engage in (Mount et al., 2005).

There are many investigations into to the degree of similarity between vocational interests represented by Holland's types and personality designated by the Big Five personality traits. Let us look at four frequently cited examples, two of an earlier and two of a more recent date.

Ackerman and Heggestad (1997) conducted a meta-analysis of the relationship between personality, interests, and intellectual abilities. With respect to the personality–interest correlations, they observed that neither Agreeableness nor Neuroticism was correlated with any of the Holland's types. Conscientiousness showed a moderate correlation with Conventional interests, and Extroversion a moderate correlation with both Enterprising and Social interests. Openness to experience was moderately-to-substantially correlated with Investigative, Artistic and Social interests.

Costa at al. (1984) demonstrated high correlations between Extroversion and Enterprising, and moderate to large correlations between Extroversion and Social interests. Moreover, Openness showed a strong relationship with the Artistic type, and a moderate relationship with the Investigative type.

In a more recent meta-analytic study, Barrick, Mount, and Gupta (2003) obtained the strongest relationship for the Enterprising and Social types, and the dimension of Extroversion ($\rho$ = .41 and $\rho$ = .29, respectively), and between Artistic and Investigative interests, and the dimension of Openness ($\rho$ = .39 and $\rho$ = .25, respectively). The remaining 26 correlations were very small to moderate ($\rho$ < .25). Moreover, Realistic interests were not related to any of the five personality dimensions. Ultimately, Barrick and colleagues suggested that the relationship between both psychological constructs could be better explained by two higher-order dimensions of five factors. Those two dimensions are represented by Digman's (1997) personality Factor α (impulse restraint, conscience, low hostility and aggression, and neurotic defense) and Factor β (actualization of the self, venturesome encounters with life, openness to new experiences, and use of intellect). Indeed, Mount et al. (2005) found support for this hypothesis by demonstrating that similarities and differences between vocational interests and personality were much better expounded by the interrelation of both Factors α and β, and vocational interests (or Factor γ as the authors called it). All three factors comprised three distinctly different motivational constructs which jointly influenced motivation.

All things considered, even though the presented results indicate that there are significant relationships between specific vocational interests and particular personality traits, the two models of individual differences do not appear as interchangeable. Vocational

interests cannot be regarded as personality variables. ″Vocational interests are vocational interests. They are uniquely defined″ (Crites, 1999, p. 164).

**Alternative models to Holland's RIASEC hexagon**

Despite its apparent robustness, Holland's model has been widely disputed and supplemented with new dimensions. Consequently, several studies have offered an alternative view on the structure on vocational interests by dealing with possible inconsistencies and imperfections of the hexagonal model.

Prediger (1982, 1996) and Prediger and Vansickle (1992) reformulated Holland's hexagonal model by contending that the primary and fundamental structure of vocational interests was better represented by two distinct dimensions. Those dimensions fall between different RIASEC types indicating that interests blend into each other across different values of the two dimensions. The first *people versus things* dimension refers to preference for work activities that involve interacting with other people versus work activities that involve using tools, machines and objects. As depicted in Figure 1, the people pole corresponds with the Social type and the things pole with the Realistic type. The second *data versus ideas* dimension adverts to preference for working with concrete data and practical solutions versus abstract concepts and ambiguous ideas. In Figure 1, the data pole falls between Conventional and Enterprising, and the ideas pole between Investigative and Artistic. Silivia (2006) have asserted that Prediger's model complements rather than contradicts Holland's hexagon, as both models are dependent on each other. In fact, Prediger's dimensions would become invalid if the order of RIASEC types was also invalidated. Instead of treating Prediger's model as an alternative to Holland's hexagon, both poles should just as well be regarded as higher-order factors of the RIASEC types (Barrick et al., 2003).

Hogan (1983, as cited in Hogan & Blake, 1999) also argued that two fundamental, bipolar dimensions labelled *conformity* and *sociability* underlain Holland's typology. As schematized in Figure 1, Conformity is aligned with the hexagon so that the Artistic and Conventional interests represented its low and high poles. Sociability bisects two sets of interest types: the Enterprising–Social angle, and the Realistic–Investigative angle.

Gati (1991) went further than Prediger and Hogan by drawing attention to several theoretical weaknesses of the RIASEX model, such as the number of factors and their interpretability, ordering of the types, and the distance between them, among others (see Gati, 1979, 1991, for detailed descriptions). The author proposed a hierarchical structure as a better representation of the vocational interest structure. Interests are arranged in several

hierarchical levels with two major groups *soft science* and *hard science* at the highest level (Gati, 1979), and smaller groups at the lower level. The groups on the higher level are identified on the basis of the most salient aspects. The identification of increasingly finer distinctions between the types, work activities and occupations, based on the relatively less salient differences, is done in several steps (Gati, 1991). The hierarchical model resembles a ″tree″ with the types being located at the end of the branches (Gati, 1991). The similarity and dissimilarity between the types is reflected by the distance between the branches. The closer they are to each other, the more aspects and features they have in common. As depicted in Figure 2, the RIASEC types collapse into three clusters in Gati's hierarchical model: Realistic–Investigative, Artistic–Social, and Enterprising–Conventional (Gati, 1991). According to Gati (1991), the hierarchical approach opens the door to the flexibility in the number of steps, levels, and clusters used to describe the structure of vocational interests. Holland preferred six clusters, while other researchers may take more as a starting point. For instance, based on scores on the 34 JVIS scales and using the hierarchical approach, Jackson, Holden, Locklin and Marks (1984) identified 17 clusters associated with academic majors that were organized hierarchically into second-order ″super clusters″ serving to define a higher-level organization of vocational interests.


*Figure 2.* A schematic representation of the Holland's typology (Holland, 1973, 1985, 1997) as the hierarchical model. (R = Realistic; I = Investigative; A = Artistic; S = Social; E = Enterprising; C = Conventional). Adopted from Gati (1979, 1991).

On the basis of the meta-analytic evaluation of Holland's and Gati's vocational interest models, Tracey and Rounds (1993) demonstrated that Holland's model was a more valid and superior representation of the structure of vocational interests and work environments, as compared to Gati's approach. However, they also argued that the structure of interests looked more like a circle than a hexagon (see Figure 3; Tracey and Rounds, 1993, 1995, 1996). The core of Holland's theory that measures of vocational interests should form

six coherent clusters is consequently challenged by showing that interests form a uniform circular distribution, in which interests disperse evenly in a circular fashion, forming a circumplex (Tracey & Rounds, 1995, 1996). Contrary to a hexagon, a circle has an infinite number of points, so it can be sliced in many different ways. As a result, the number of vocational interest clusters or scales is just a matter of convenience (Tracey & Rounds, 1995, 1996). Under different circumstances and dependent on applied or pragmatic purposes of researchers or counsellors, six types will no longer be the ideal number. It is just one of many ways of slicing a circle (Silvia, 2006; Tracey & Rounds, 1995, 1996). If one wishes to work with an easy interpretable and unambiguous structure of interests, for example, in a counselling situation, one may choose a simple representation of the circle (such as Prodiger's dimensions or Holland's model). If one chooses to describe or study interests in a more complicated and detailed manner, one may focus on a differentiated circle that carves out many distinctions or octants (see Figure 3) within each RIASEC types.

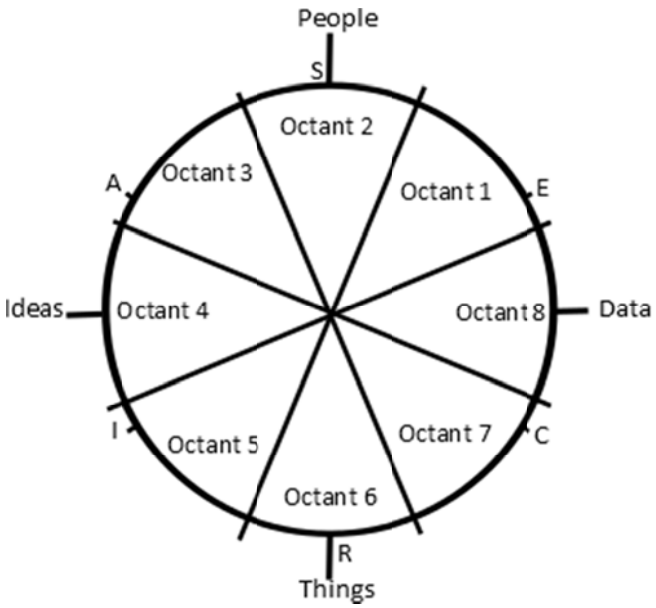


*Figure 3.* Spatial representation of Holland's RIASEC types (Holland, 1973, 1985, 1997), and Prediger's things people versus things dimension and data versus ideas dimensions (Prediger, 1982, 1996; Prediger and Vansickle, 1992). (R = Realistic; I = Investigative; A = Artistic; S = Social; E = Enterprising; C = Conventional). Adopted from Tracey and Rounds (1996).

Tracey and Rounds (1995, 1996) complicated their model even more, by adding a dimension of occupational prestige. In the authors' opinion, occupational prestige has been a neglected construct in the studies of vocational interest structure, despite strong evidence that

people choose jobs based on the prestige level (Rounds & Zevon, 1983). The addition of the prestige dimension turns the circumplex model into a three-dimensional sphere – the spherical model of vocational interests (Tracey & Rounds, 1995, 1996; see Tracey & Rounds, for a detailed description).

In Norway, Solberg (1999, as cited in Fiske & Berge, 2011) based the construction of his interest inventory *Solbergs interessetest* on Holland's vocational typology. However, he expanded the Investigative vocational personality by dividing it into two theoretical categories. As a result, Solberg differentiated between the Investigative natural science type (*teoretisk naturvitenskaplig type*) and the Investigative cultural and social science type (*teoretisk kultur- og samfunnsfaglig type*, my translations), in addition to the Realistic, Artistic, Social, Enterprising, and Conventional type (Solberg, 2008). As we will see later on, Jackson (2000) also made a distinction between more than six different types while constructing the JVIS. He called those types the general occupational themes.

**Relationship between vocational interests and job satisfaction**

The popular and widely disputed thesis in psychology is that productivity, satisfaction and mental health are directly related to the congruence between the characteristics of individuals (e.g. abilities, personality traits, values and vocational interests) and demands of a job. This idea of the interaction between people and work environment (Schneider, 1987) is often known as the congruence theory or the person-environment fit (called P–E fit from now on) (e.g. Pervin, 1967; Furnham, 2001). Specifically, congruence is the concept measuring the P–E fit (Furnham, 2001).

The modern theory of work adjustment (see e.g. Swanson & Schneider, 2013) is also considered a model of P–E fit. The theory focuses on how the symbiosis between people's needs, and the rewards embedded in the work environments, as well as between individuals' abilities and demands made by the work environments, affect central outcomes such as satisfaction or tenure. Since this study deals with vocational interests, I will naturally focus on theories and studies of the fit between people's vocational interests and work environments. Moreover, as one of the variables in my study is academic satisfaction, I will refer only to the research that deals with the P–E fit and vocational interests as moderators of job satisfaction and academic satisfaction. Job satisfaction is in fact the most frequently investigated job outcome in this context (Tinsley, 2000). Once again, within this area, Holland's work (Holland, 1973, 1985, 1997) is of vital importance.

As briefly mentioned above, the defining features of the RIASEC categories apply both to vocational personalities and work environments. An environmental model may be defined as a situation or an atmosphere created by people who represent specific vocational personality types, and who dominate a given environment (Holland, 1973, 1985, 1997). Accordingly, similar to the structure of vocational interests, occupational environments form a coherent hexagonal structure. Holland's theory states that vocational satisfaction and turnover are dependent on the degree of fit between people's vocational personalities and occupational environments (Holland, 1973, 1985, 1997). For example, people with Social interests will be most satisfied in Social work environments, because this kind of environments will stimulate them to engage in Social activities, such as teaching, helping, treating or training others. These activities will in turn foster Social competencies. They will also feel best in work environments populated by people with the same Social interests.

Several studies adopting Holland's typology have shown that the congruence between vocational interests and occupational environment is linked to greater satisfaction. For example, Furnham and Schaeffer (1984) demonstrated in a sample of 82 full-time working adults, a negative relationship between P–E fit, and mental health ($r = –.24$), and a positive correlation between congruence and job satisfaction ($r = .37$). Mount and Muchinsky (1978) found that the overall job satisfaction measured by salary, promotions, supervision, and coworkers was significantly higher for the congruent employees from five environmental typologies (i.e. all but Artistic which was not included in the study), compared to the incongruent employees. However, they also demonstrated that some environments, such as the Social environment, were more satisfying than others, regardless of the P–E fit.

Even though these studies provide strong support for the hypothesis that pairing people and environments is related to job satisfaction, there are studies which have produced more inconclusive results. Furnham, Toop, Lewis, and Fisher (1995) provided a marginal support for the congruence theory in three British samples. However, the relationship between job satisfaction and P–E fit was directly tested only in two of them. In a first sample of 62 managers and 73 non-managers from 11 companies, the primary hypothesis that congruence and satisfaction would be positively and significantly correlated was not supported, except for one subscale of job satisfaction – the kind of work. The hypothesis that congruence and job satisfaction would be correlated was also not supported in the second sample of 60 female speech therapists.

In a meta-analysis of 27 studies, Tranberg, Slane, and Ekeberg (1993) reported a low non-significant mean congruence–job satisfaction correlation of $r = .20$, based on 17

correlations and a total of 8,608 respondents. The highest correlation for congruence and satisfaction was reported for the Social type ($r$ = .33), whereas the correlations for the other five types ranged from .05 (Realistic) to .15 (Conventional). The exact significance levels for those correlations could not be determined, but the findings suggest that there might be differences between Holland's types in the importance of congruence for satisfaction.

**Vocational interests and academic satisfaction**

Even though researchers studying the effect of congruence have mainly focused on outcome variables in a work context, there are few that have examined how the fit between vocational interests and academic environment relate to academic satisfaction.

Nafziger, Holland, and Gottfredson (1975) found support for the congruence theory in a sample of 1,878 students. Even though their results were limited in several ways (e.g. small sample, small effects or non-generalizability of the results), positive and significant results for person–environment interactions were observed, even for a time interval from 10 months to 3 years. Specifically, congruence with major field was a predictor of satisfaction with the academic environment within that field (i.e. other students, professors and activities), but it did not predict satisfaction with the total college environment (Nafziger et al, 1975).

Based on a sample of more than 10,326 students followed for a period of two years, Smart (1987) found that students satisfaction with the programme, staff–student relations and peer relationship was a function of congruence. In a study by Tranberg et al. (1993), the mean correlation between congruence and college major satisfaction, based on 5 correlations and a total of 2,560 respondents, was positive ($r$ = .10), but non-significant.

In sum, the congruence hypothesis remains controversial at best and ″a myth″ at worst (Tinsley, 2000). Tinsley (2000) has stressed that the hexagonal model provides a valid and useful way of thinking about the interaction between the individual and the environment, even though it does not serve as the best predictor of important vocational or educational outcomes. Still, he calls for further conceptual development in multiple, bigger and more representative samples, using longitudinal designs and commensurate rather than general measures.

It is one of the objectives of the current study to test the concurrent value of the JVIS scores for student satisfaction. The concept will be measured by two different scales: satisfaction with the academic environment and satisfaction with the social environment.

**Vocational interest measures**

Taking Strong's (1943) pioneering work as a starting point, researchers typically measure vocational interests by means of vocational interest inventories. There are several inventories available in English which are generally regarded as reliable and valid measurement tools. For example, Su et al. (2009, p. 865) mentioned seven most highly regarded American interest inventories. The authors based their evaluation on a number of citations in at least one third of the 14 most currently published professional test and measurement textbooks. Three of the inventories, included in their list, have already been presented, that is, the Strong Interest Inventory (cited 13 times), the Self-Directed Search (cited 13 times), and the Kuder Occupational Interest Survey (cited 10 times). The JVIS, which will be described in more detail in due time, is on their list as well (cited 8 times).

Svendsrud (2010) has given an overview and a short evaluation of various vocational interest inventories available on the Norwegian market. Most of them are based on Holland's model (e.g. *Karrieretesten.no*, *Veivalg*, Work Interest Explorer). Some inventories are ipsative (e.g. *Veivalg* and *Solbergs interessetest*), one is image-based (*Jobpics*), and the scales of others are based on Likert items (e.g. *Karrieretesten.no* and *Navs interessetest*). Some inventories present lists of occupations, activities and abilities (e.g. *Veivalg* and *Solbergs interessetest*), others give a possibility of interactively exploring own career path by choosing the most relevant areas of interest (e.g. Work Interest Explorer). Some Norwegian interest inventories serve as free self-help tools (e.g. *Navs interessetest* and *Veivalg*), administration of others require more professional training or certification (*Solbergs interessetest*, Work Interest Explorer and *Jobpics*).

**Interests and abilities**

It seems legitimate to pose a hypothesis that people have a strong interest in what they are able to do well. Originally, psychologist examined ability as an important variable in the search for the determinants of interests (Savickas, 1999). Following the first investigation of interests–ability relationship in college juniors, Thorndike (1915, p. 394) concluded that ″the resemblance between interest and ability may safely be placed at about .9 of perfect resemblance.″ The controversy over that study is the use of subjective measures of ability. Research on self-assessment actually shows that people rarely manage to judge their abilities accurately (Sedikides & Strube, 1997; Silvia & Gendolla). Moreover, the inaccuracy of self-assessment is often a consequence of incompetence (Kruger & Dunning, 1999). People who

are in reality not good at something often overestimate their actual ability, while individuals who possess necessary skills in a certain area make more accurate ability judgments.

Nowadays, most psychologists agree that ability and interests are independent variables with a small to moderate relationship (Savickas, 1999; Silvia, 2006). For example, Lent et al. (1994) found a low correlation ($r$ = .20) between ability and interests in their meta-analysis. Walsh (1999) clearly stated that the two constructs did not seem highly related in spite of their apparent interaction with each other. Some early researchers also concluded that interests and abilities were only modestly correlated (Super, 1949).

There is, however, wide agreement that optimal educational and vocational counselling relies on the independent assessment of interests and abilities (Lubinski & Benbow, 2006; Savickas & Spokane, 1999). Abilities are important for career choice, but adding interests make prediction of educational and vocational choices even more precise (Robertson, Smeets, Lubinski, & Benbow, 2010).

Moreover, the most influential models that seek to explain job performance are based on components related to motivation and ability (Mount et al., 2005). According to Mount et al. (2005), vocational interests along with personality traits are such important motivational components. According to Ackerman and Heggestad (1997), abilities, interests, and personality develop in tandem, such that ability level and personality dispositions determine the probability of success in a particular task domain, and interests determine the motivation to attempt the task. Some researchers also focus on self-efficacy as an important motivational attribute. They explore its relationship with vocational interests and outcome expectations. In short, they test the hypothesis that people will form enduring interests in activities which they feel they can master, and in which they anticipate positive outcomes (Lent et al, 1994).

In an article on the Norwegian interest inventories, Svendsrud (2009) pointed out that the most thorough interest inventories often consisted of three different parts: questions about occupational titles, activities and abilities. When it comes to the first and the second type of items, respondents are asked to identify occupational roles and work activities that match their vocational interests. The possible questions are: ″Would you like to be a doctor?″ (title) and ″Are you interested in treating patients?″ (work activity). As far as the last group of questions is concerned, one often turns to direct inquires about an individual's actual occupational abilities, for example ″Can you draw blood from patients?″ As mentioned in the previous section, some of the most popular Norwegian interest inventories follow that item classification (e.g. *Veivalg* and *Solbergs interessetest*). The Self-Directed Search also includes self-assessed measures of abilities in the specific area (Gottfredson & Holland,

1975; Jigău, 2007). According to Svendsrud (2009), the inclusion of ability categories in vocational interest inventories is not always favourable, because it can lead to the exclusion of significant educational and occupational alternatives which could otherwise be discussed during the counselling process.

**Sex differences in vocational interests**

Nordvik (1991a) conducted a study on sex differences in vocational interests among 842 Norwegian female and 678 Norwegian male clients at Local Employment Services in 1981–1990. He found considerable interest differences between men and women which were in harmony with traditional notions of male and female professions. The most popular occupation categories among men were Technology/Mechanics, and to a lesser extent Construction/Installation and Shipping/Fishery. According to women, the most attractive occupations involved activities in the area of health care. Teaching/Counselling and Customer Service were also regarded as feminine categories. Nordvik (1991a) concluded that the existing gender disparities were smoothing out, especially in the young population.

Still, almost thirty years later, Schreiner (2006, 2008) pointed out several similar sex differences in the Norwegian student population. Those differences indicate that boys are more interested in technology, mechanics, and various inventions, while girls show a strong preference for human biology, caring and curing, metaphysical questions, imaginary world, and animals. The results are based on ROSE (The Relevance of Science Education), a comparative study of 15-year-old students' perceptions of science and science education.

The question of sex differences in vocational interests has also been important in American research. Accordingly, psychologists have discussed potential contributors to gender disparity in the areas of science, technology, engineering, and mathematics (STEM) (e.g. Ceci & Williams, & Barnett, 2006). Vocational interests, potentially representing both free and constrained choices, are listed among the most critical and powerful explanatory factors for women's underrepresentation in these fields (Ceci et al., 2006; Su et al., 2009). For example, interest factors may be one of the most important explanations for why even math-proficient women tend to prefer work in non-math-intensive fields (Ceci et al., 2006).

Generally, men more often than women prefer technical, scientific, and mechanical activities. On the other side, women are more likely than men to show interest in social and artistic activities (Betz & Fitzgerald, 1987). In three separate studies, Lippa (1998) provided evidence that gender differences were strongly related to Prediger's people versus things

dimension of vocational interests (Prediger, 1982, 1996; Prediger and Vansickle, 1992), with men positioning themselves on ″the things side″, and women showing a tendency towards ″the people pole″. In consequence, Lippa (2001) presented the hypothesis that masculinity–femininity was a bipolar trait that strongly overlapped with the people versus things dimension.

A study conducted by Su et al. (2009) confirmed the ″people–things″ sex differences in vocational interests. Men also showed a greater preference for mathematics, engineering and science. As to Holland's types, men were more likely to represent the Realistic and Investigative types, whereas women's interests were of a more Artistic, Social and Conventional character. The three largest effect sizes were demonstrated for people versus things dimension ($d$ = .93), as well as for the Realistic type ($d$ = .84) and for the Social type ($d$ = –.68). The meta-analysis was based on technical manuals of 47 interest inventories, included the JVIS, and 503,188 respondents. Su et al. (2009) have concluded that interests play a critical role in occupational and academic choices.

Much of the debate on the sex disparities concerns sex-balance of interest inventories (Su et al., 2009). In particular, different interpretation of scores for men and women may reflect the sex restrictiveness of a particular interest inventory. Consequently, most of vocational interest tests are sex-balanced and sex-neutral. The JVIS was also constructed in accordance with this approach (Jackson, 2000). Removing items that discriminated between sexes was an important issue in the construction of the JVIS. Nevertheless, some researchers have argued that accounting for sex differences while developing interest inventories is important (Gottfredson & Holland, 1975). Their argument is that sex-balanced scales affect the validity of interest inventories and the effectiveness of vocational counselling.

One of the objectives of the present study is also to explore gender differences in vocational interests.

**The structure of the JVIS**

The JVIS was created by American psychologist Douglas N. Jackson. The instrument was first published in 1977. Apart from small modifications of 16 scales, few changes have been made to the original version (Jackson, 2000; Murphy & Davidshofer, 2005). The JVIS is used for facilitating decisions regarding educational and vocational choices. It also serves as a supporting tool in the process of career planning (Jigău, 2007).

The JVIS consists of 289 pair of items which refer to different vocationally relevant and relatively homogeneous activities. Items are arranged in a forced-choice item format. The

respondents are asked to read two statements in each item pair (statement A and B) and decide which one of them refer to activities they find most interesting (Jackson, 2000).

The items are grouped into 34 basic interest scales. Each scale consists of 17 items, thus raw scores for each scale range from 0 to 17. The items are arranged in such a way that an item from each of the 17 basic scales in the A group is paired with en item from each of the 17 basic scales in the B group. As a result, scales within the same group, as well as items within the same scale are never directly compared with each other. Consequently, the JVIS can be treated as an interest inventory composed of two separate and independent ipsative measures (Murphy & Davidshofer, 2005).

Twenty-six of the basic scales are called the *work role* scales, the remaining eight – the *work style* scales (Jackson, 2000). Jackson (2000) emphasized that each scale was interpretable in its own right based on the items showing the highest association with that scale. However, alternative categorization of scales was possible and could be useful for other purposes. The main objective of the current study is to determine if the translated version of the JVIS will have a similar structure to that of the original inventory.

The work role scales consist of activities relevant for particular occupations. A set of scores for work role scales represent job-related interests (Jackson, 2000). They are either closely associated with a particular occupation or a class of occupations, for example Medical Service, Law or Office Work, or applicable to particular work roles in different occupations and professions, for example Human Relations Management, Professional Advising or Business. The examples of work role scales are Creative Arts, Mathematics, Physical Science, Medical Service, Adventure, Nature-Agriculture, Skilled Trades, and Teaching.

On the other side, scales reflecting work styles are designed to measure preference for work environments that require specific modes of behaviour, even though the immediate tendency is to treat these as personality characteristics (Jackson, 2000). Thus interests measured by means of work style scales can apply to various jobs and professions. Consequently, they offer a more elaborate and complete picture of an individual's preferences and career priorities. Among work style scales, one can find Planfulness, Dominant Leadership, Job Security, Stamina, Accountability, and Academic Achievement. A full description of the 34 Basic Scales (i.e. both the work role scales and the work style scales) is given in Table B1 in the Appendix.

The JVIS has undergone a detailed development process (see Jackson, 2000, for a detailed description). The conceptual foundation of the JVIS is based on David Campbell's work with the Strong Vocational Interest Blank (se Campbell, 1971). The biggest difference

lies in the fact that Jackson focused more on of the career exploration and planning rather than on measuring the degree of similarity between people's vocational interests and a preference pattern in different occupations (Jackson, 2000; Murphy & Davidshofer, 2005).

The first step in the JVIS construction was the development of 3,000 statements (and 34 scales) that were administered to 2,203 respondents (Jackson, 2000). Only items that consistently discriminated for males and females were used. The original analyses concentrated on suppressing response bias resulting from the initial item format (tendency to "like" or "dislike" an activity in each statement). In the next step, orthogonal factor analyses were used to produce factors that were uncorrelated with other factors and with response bias, and to identify statements that were related to each basic interest scale. The items belonging to different scales were paired using a computer program, which was written for that particular purpose. As a result, items with similar endorsement frequencies were paired so as to enhance item variance and scale reliability (Jackson, 2000). The JVIS was renormed in 1999 with 3,500 American and Canadian secondary school students and adults (1,750 women and 1,750 men) (Jackson, 2000).

The methods applied in the construction of the JVIS were criticized by Juni and Koenig (1982). The researchers highlighted several weaknesses that had an impact on the validity of the inventory. For example, the rationale for pairing items referring to apparently different aspects of vocational interests (e.g. work roles and work styles, work activities and leisure activities, single events and overall roles) was unclear for the researchers and confusing for the respondents. Juni and Koenig (1982) criticized also the fact that the qualitative screening of the final items and the pairs of items by an experienced expert had been neglected at the expense of the quantitative item intercorrelations, statistical clustering and computer-based construction methods.

One of the unique features of the JVIS is the fact that it allows both hand and machine scoring (Murphy and Davidshofer, 2005). The latter method provides additional groups of scales which are not available with the hand-scored version. These additional groups include 10 *general occupational themes*, similarity with the interest profiles of college students majoring in various academic disciplines (17 academic clusters) and similarity with vocational interests of people in different occupations (32 groups) (Jackson, 2000; Jigău, 2007; Murphy & Davidshofer, 2005).

The general occupational themes indicate broad patterns of interest rather than preferences for work-specific activities. The occupational themes are inspired by Holland's classification even though they are not always directly comparable with the RIASEC types

(Jackson, 2000). The general occupational themes can in fact be grouped together to give scores for the RIASEC categories (Jigău, 2007; Murphy and Davidshofer, 2005). The 10 general occupational themes are called Expressive, Logical, Inquiring, Practical, Assertive, Socialized, Helping, Conventional, Enterprising and Communicative (Jackson, 2000; see Table B2 in the Appendix for detailed descriptions of the occupational themes).

Scales indicating similarity to academic clusters are based on the analyses of the JVIS profiles of 10,134 university students, both males and females, from 131 academic majors (Jackson et al., 1984). A high score indicates similarity of a respondent's interest pattern with that of a particular group of students. A low score suggests dissimilarity. A high score also indicates that en individual shows a preference for specific university majors or clusters, for example Engineering, Business, Education, Social Science, Law, and Art (Jackson, 2000).

Scales describing similarity of the JVIS basic profile to different job groups are interpreted in a similar manner. A positive score indicates some degree of similarity to the interests of people already employed in a specific occupation, while a negative score points towards a possible dissimilarity. Among 32 job groups, one can find e.g. Agriculturalists, Health Service Workers, Occupations in Music, Clerical Services, Personnel/Human Management or Engineering and Technical Support Workers (see also Jackson & Williams, 1975 for a preliminary research on the occupational classification).

The JVIS also offers a general *Academic Satisfaction* score, which can be useful in predicting the degree of satisfaction with academic activities such as reading, research or solving intellectual tasks in different educational settings (Jackson, 2000).

The JVIS has been widely used in research (see e.g. Jackson, 2000 for a research overview). One the most recent studies using a modified version of the JVIS – the Jackson Career Explorer (i.e. a shortened version based on a 5-point Likert scale) – revealed that thirty of the 34 vocational interest scales had a genetic component with heritability values ranging from 37% (Elementary Education and Supervision) to 61% (Social Science) (Schermer & Vernon, 2008). Furthermore, four of the interest scales were found to have common environment effects between 28% and 46% (Human Relations Management, Dominant Leadership, Sales, and Business, respectively).

**Reliability and validity of the JVIS**

The verification of reliability of the JVIS was performed by test–retest methods. The study with a sample of 172 students who completed the test one week apart, revealed that the reliability coefficients ranged from $\alpha = .72$ for the Independence scale to $\alpha = .91$ for the

Social Service scale, with a median of $\alpha$ = .84 (Jackson, 2000). The estimate of test–retest reliabilities in the second study was based on a sample of 95 first year university students, 43 men and 52 women who completed the JVIS on two occasions separated by four to six weeks (Berk & Fekken, 1990). The reliability coefficients ranged from $\alpha$ = .69 for Independence and $\alpha$ = .92 for Social Sciences, with a median of $\alpha$ = .82 (Berk & Fekken, 1990, the unpublished data cited in Jackson, 2000). The long-term stability of the JVIS has yet to be tested (Murphy and Davidshofer, 2005).

Internal consistency coefficients (coefficient *theta* for a composite score, see e.g. Bentler, 1972) for the JVIS basic interest scales, estimated in a sample of 1,573 high school students, 799 males and 774 females, were in the range between $\theta$ = .70 for Personal Advising and Accountability, and $\theta$ = .91 for Adventure, Medical Service and Social Service (Jackson, 2000). A median was $\theta$ = .81. Reliability coefficients for a normative sample of 1,750 males and 1,750 females varied from $\alpha$ = .54 for Professional Advising to $\alpha$ = .88 for Mathematics, with a median of $\alpha$ = .72 (Jackson, 2000).

Internal consistency of the general occupational themes based on the normative sample ranged from $\alpha$ = .72 for the Assertive theme to $\alpha$ = .93 for the Logical theme (Jackson, 2000). Additional studies of test–retest reliabilities for occupational themes revealed a median values of $\alpha$ = .89 (one week apart), and $\alpha$ = .90 (four to six weeks apart) (Jackson, 2000).

Jackson (2000) also demonstrated that the JVIS profiles remained quite stable over time. The range for the individual profile stability with 52 university students, 34 females and 20 males, taking the JVIS on two occasions within a two-week period was $\alpha$ = .59 to $\alpha$ = .96, with a median of $\alpha$ = .87. In the second study, based on a sample of 172 college students taking the survey one week apart, a median profile stability was $\alpha$ = .88. The third study carried out with a sample of 102 medical school applicants taking the JVIS on two occasions separated by six months, showed a median profile stability coefficient of $\alpha$ = .88. The mean individual stability coefficient for the general occupational themes was $\alpha$ = .94. The calculation was based on 54 persons completing the inventory on two occasions.

Jackson (1971, 2000) meant that rationally developed scales were more meaningful and interpretable, and more useful in counselling than the scales derived empirically. Accordingly, he employed the rational and theoretical method of scale construction. All the basic JVIS scales are grounded on the author's theoretical ideas. According to Ashton and Goldberg (1973), conceptual and intuitively constructed scales show equal validity and stability (even if developed by novices) to those based on time-consuming empirical

strategies. Goldberg and Slovic (1967) also advocated the use of conceptually derived scales by demonstrating that only scales consisting of items with high face validity also had significant cross-validity. Savickas (1999) and Silivia (2006) also favour the conceptual approach to vocational interests criticizing the prevailing empirical nature of research on this topic.

Jackson (2000) reported that construct validity, tested by means of factor analytic techniques, was high. Concurrent validity of occupational clusters was also high. Workers in various occupations scored highest on those scales that would be expected on a priori basis (Jackson, 2000; Murphy and Davidshofer, 2005). The same applied to academic clusters. Different JVIS profiles were consistent with the expected academic groups (Jackson et al., 1984). Jackson (2000) also reported a substantial degree of high correlations between the scales of the JVIS and the Strong Vocational Interest Blank, for example $r = .75$ between respective Medical Service scales and $r = .74$ between the respective Physical Science scales. Locklin (1976) examined predictive validity of the JVIS. He carried out a study in a large sample of freshmen at the Pennsylvania State University who completed the JVIS during the orientation week. The JVIS scores correctly predicted actual college enrollment at a rate of about 60 percent for both men and women.

**Ipsative and normative measures**

Data is described as ipsative if a given set of responses always sum to the same total (Loo, 1999). Ipsative measures are clearly represented whenever respondents are asked to rank two or several options as ″most like me″ and ″least like me″ (Meade, 2004). Thus the forced-choice questionnaire format of the JVIS makes it an ipsative inventory. In contrast, normative measures use rating scales where respondents simply rate rather than rank options, for instance, using Likert items (Loo, 1999).

In general, ipsative scales are interrelated because they must sum to the same total across scales for each participant (Meade, 2004). The main problem regarding the use of the ipsative measures are the statistical difficulties that lead to the constraints on scale intercorrelations in factor analyses (Cornwell & Dunlap, 1994). The correlation matrix will have many negative and high correlations (i.e. negative multicollinearity) based on the artifactual bipolar structure of ipsative measures (Cornwell & Dunlap, 1994; Loo, 1999; Meade, 2004). Specifically, scales that originally represent opposite poles will tend to correlate negatively, given the conceptual relationships between variables, even when positive correlations are expected (Loo, 1999). Moreover, while normative data produces

single constructs, ipsative data typically gives bipolar factors (Baron, 1996). Bipolar factors seem to reflect the forced-choice format, where choosing one scale, inevitably means ignoring another (Baron, 1996). Loo (1999) stresses that even if factor solutions present meaningful factors, it is still questionable if these factors truly reflect the underlying theory, or just the structure of artifactual bipolar factors. The problem is so substantial that some researchers argue against factoring ipsative measures (see e.g. Cornwell & Dunlap, 1994; Johnson, Wood & Blinkhor, 1988; Meade, 2004).

Ipsative measures also fail to meet criteria for classical psychometric analyses, which assume the interval level of measurement. As a result, the researchers strongly advocate the use of psychometrically superior normative measures (Cornwell & Dunlap, 1994; Johnson et al., 1988; Loo, 1999; Meade, 2004). However, those superior normative scales are often not exactly at the interval level, either, even though many researchers criticizing ipsative measures regard them as such (Baron, 1996). For example, Likert items represent the ordinal-level variables.

In addition, ipsative measures affect the internal reliability of the instruments by frequently inflating reliability coefficients (Tenopyr, 1988). According to Johnson et al. (1988), they are also not suitable for comparing individuals on a scale by scale basis, and should be used only for intra-individual comparisons.

There are several methods that are listed as possible solutions to the problems described above. Firstly, transforming data into normative measures may eliminate much of analytic bias caused by ipsative measures (Loo, 1999). However, the profiles obtained after the transformation may be very different from the original ones (Baron, 1996). Secondly, to minimize negative intercorrelations between ipsative scales, it is preferable to group items in such a way that scale items in an item set would appear with each item of the other scales an equal number of times (Meade, 2004). Thirdly, nominal analytic procedures (Cornwell & Dunlap, 1994; Loo, 1999), the item response modelling (Brown, & Maydeu-Olivares, 2013), and other confirmatory factor techniques (Jackson & Alwin, 1980; Meade, 2004) can produce more sound results while analyzing ipsative data. Principal component analyses may also be a better choice than factor analyses (Cornwell & Dunlap, 1994).

Despite the extensive critique of the ipsative measures, some researchers demonstrated that ipsative scores could be factored to produce interpretable results (e.g. Saville & Willson, 1991). Reliability coefficients were not overestimated, and the ipsative alpha values were even slightly lower than the normative (Saville & Willson, 1991). Moreover, the correlations with normative equivalents were high, and the ipsative scores

correlated higher with hypothetical ″true″ scores. Both types of scales also correlated significantly and strongly with external (normative) ratings, especially when the number of scales was large (e.g. 30+) (Saville & Willson, 1991). In fact with more scales, ipsative measures can provide results which are psychometrically valid and similar to those obtained by normative data (Baron, 1996; Saville & Willson, 1991).

Psychologists usually argue for the use of ipsative scaling based on two main arguments: to avoid social desirability and to reflect the position that life is about choices (Baron, 1996; Saville & Willson, 1991). Since people are ″forced″ to choose between different alternatives, it may be more difficult to fake ipsative questionnaires. Additionally, forced-choice format reflects the fact that people often have to choose between different options. Taking those two main arguments as a starting point, Meade (2004) discussed different types of constraints ipsative measures put on a decision-making process, for example, having to choose between items that are very different in tone (e.g. one more extreme, the other more moderate) (see Meade, 2004 for a detailed description). According to Meade (2004), a forced-choice item format invokes a specific decision process which causes item-level interdependence and changes the psychometric properties of the scale. Specifically, responses and scores become interdependent by not only measuring the construct they are designed to measure, but also other constructs within the context of the item set. Meade (2004) also demonstrates that it is possible to fake forced-choice questionnaires, especially when the alternatives are very different in tone (i.e. positive versus negative wording).

All things considered, the researchers criticize the use of ipsative data in employee selection (Johnson et al., 1994; Meade, 2004). However, there are some applications in which ipsative measures may be more preferable to normative tests. Vocational interest inventories are good examples in that respect (Meade, 2004).

## Hypotheses

Based on the presented theory and the described studies, there are four hypotheses which will be investigated in the next sections:

**Hypothesis 1:** The structure of the Norwegian version of the JVIS will be similar to the structure of the American version of the inventory.

**Hypothesis 2:** The six student group will show the strongest interest in activities represented by the JVIS vocational interest scale that is closest related to their field of study.

**Hypothesis 3:** For students in the six fields of study, there will be a significant positive relationship between Academic Satisfaction and Social Satisfaction, and vocational interests represented by the JVIS vocational interest scale which is closest related to that field.

**Hypothesis 4:** There will be sex differences in vocational interests indicating that men will prefer to work with things and women to work with people. Moreover, men will show a stronger preference for activities in the field of engineering, science and mathematics, while women will be more interested in artistic activities.

# Method

## Participants

The study sample included 484 Norwegian students (337 females and 147 males) from different study programmes at the Norwegian University of Science and Technology (NTNU) in Trondheim. Students from one-year programmes ($n$ = 13), Bachelor's programmes ($n$ = 159), two-year and five-year Master's programmes ($n$ = 78 and $n$ = 182, respectively), as well as vocational programmes in Medicine and Psychology ($n$ = 52) participated in the study. Several major fields of study were represented.

## Criteria for valid responses

514 respondents in total participated in the study. However, only responses from 484 students were regarded as valid and retained for further analyses. The completion time of minimum 17 minutes and a number of 10 or fewer missing responses for the JVIS items were the validity criteria in that matter. These criteria were chosen to eliminate potential bias. The least amount of time needed for completion of the Norwegian version of the inventory was estimated at approximately 17–18 minutes, which indicated that people using less time would most probably choose the most preferred activity totally at random, without actually reading the questions. There were few respondents that did not provide responses to the JVIS questions more than 10 times, and those who did either omitted many questions or used very little time to complete the survey. Consequently, the number of 10 or less missing values seemed to be a good criterion for valid responses.

## Translation

The JVIS was originally translated by me. The translation was then revised by my supervisor, and a second Norwegian native speaker. The purpose of the study was not to achieve a verbatim translation of the inventory, but to take fully into account cultural and linguistic differences between Norwegian and American population. Due to time and economic issues, it was not possible to translate the inventory back to English (as recommended in the guidelines for translating and adapting tests, see Reas, Bang, Øverås, Lask, and Rø, 2012, and World Health Organization, 2011). Nevertheless, all ambiguous formulations were thoroughly discussed to strengthen linguistic equivalence of the translation (Reas et al., 2012). Experts in specific areas were asked to verify the correctness of

translation of specific questions, for example, a mathematician was asked to check if wording of the sentences referring to mathematics was correct.

Every translated item was checked against its original American scale so as to ensure that it actually described the activity it was supposed to describe (i.e. achieve conceptual equivalence; Reas et al., 2012). Some phrases and sentences were reformulated in order to adapt them better to the Norwegian culture, and obtain a higher degree of metric equivalence (Reas et al., 2012), while making sure that as much of the original meaning as possible was preserved.

Activities that seemed old-fashioned were checked for their applicability in modern Norway, and if necessary modified. For instance, a job activity described as ″making draperies for restaurants″ was reformulated to indicate a more common activity: ″draping of clothing″. Additionally, all items that referred to activities which are common in the USA, but at the same time do not have an immediate Norwegian equivalent, were scrutinized to find the most purposeful and appropriate substitute. To give a concrete example, ″serving as a faculty advisor″, which is a part of the Teaching scale in the JVIS, means different things in the USA and Norway. American faculty advisors are members of academic staff who first and foremost have academic duties within a specific subject or a field of study. The role of a faculty advisor in Norway is divided between academic staff members who take care of the academic side of student counselling (e.g. guidance on a particular academic topic), and study advisors whose responsibilities are of administrative character (e.g. providing general information about study programs and available courses). To make sure that this particular item fitted in the context of teaching, it was translated into ″instructing students in how to solve various academic problems″. Accounting for similar cultural and societal differences was an important part of the whole translation process.

Last, but not least, before the inventory was administered to students at the NTNU, it was tested in a small Norwegian sample to check if all sentences were precise, easily understandable and interpretable.

**Permission to reproduce copyright material**

The translation of the JVIS was authorized by Sigma Assessment Systems. Permission to reproduce the inventory was only applicable to the research in question. The agreement also presupposed that Sigma would get an access to the final report and the raw research data material. It was specified in the agreement that the JVIS could not be distributed to other parties. Consequently, it is not enclosed with the current thesis.

**Sampling procedure**

Data was collected twice, in a period from November the 11th to December the 15th 2013, and in a period from January the 15th to February the 20th 2014. There were 114 respondents on the first occasion (″the autumn group″), and 400 on the second (″the spring group″). Taking into consideration the number of variables in the study (289 pairs of items in the JVIS), the second data collection was necessary, because of a small sample size obtained in 2013. No changes were made to the original questionnaire to ensure that both ″the autumn group″ and ″the spring group″ got the same questions.

The invitation to participate in the study with a link to the survey was posted on the student intranet called *Innsida* both times. Additionally, student advisors from different faculties and departments, as well as various student organizations were contacted by e-mail during the second data collection, and asked to forward the invitation to the respective student groups. There were drawn two gift vouchers worth 400 Norwegian kroner on the first occasion and five gift vouchers worth 500 Norwegian kroner on the second occasion. The prize was drawn only among the respondents who provided answers to all the questions.

The sample was partially random, since the invitation to participate in the survey, was posted on the intranet which is freely available for all NTNU students, and partially a snowball sample, since several people were asked to forward the invitation to specific student groups.

**Ethical issues**

The research was approved by the Norwegian Social Science Data Services (NSD), which means that the project followed the code of ethics concerned with gathering and use of personal information in research, that is, obtaining informed consent, voluntary participation, protection of privacy and confidentiality (see Hellevik, 2009). Participants were fully informed about the purpose of the study. It was stressed that only the answers from the respondents who consented to participate (by clicking on ″Complete″ on the last page of the questionnaire), would be used in further analyses. Participants, who wished to take part in the prize lottery, were asked to fill out their phone number. The participants were also informed that Sigma Assessment Systems would get an access to the raw research data material.
The informed consent form is enclosed in Appendix A.

**Procedure**

The electronic questionnaire was created with a use of a web-based survey creation tool, SelectSurvey.NET. Analyses were done either in IBM SPSS Statistic Software 21 (IBM Corporation, 2012a) or in a free software environment for statistical computing and graphics R, version 2.14.0 (R Development Core Team, 2011).

In IBM SPSS, the Pearson's correlation matrix (i.e. a measure of the strength of relationship between two interval or ratio variables) is the only correlation matrix to perform exploratory factor analysis (called subsequently FA) or principal components analysis (called subsequently PCA) (Field 2013; Field, Miles, & Field, 2012; Kubinger, 2003). According to Basto and Pereira (2012), applying traditional factor procedures to binary data (two responses) and item-level data (e.g. Likert items) very often gives misleading results. Taking into account the ordinal level of the variables used to measure academic satisfaction (5-point Likert scale), but especially the binary nature of the JVIS items, polychoric or tetrachoric correlation matrices were a more proper choice for conducting PCA (Basto & Pereira, 2012; Field, 2013; Field, Miles, & Field, 2012; Kubinger, 2003).

Following the recommendations from Basto and Pareira (2012) and to overcome some of the SPSS dialog limitations, an SPSS R-Menu, version 2.2.1 was installed to allow communication between SPSS and R. Installation followed the steps specified in Basto and Pereira (2012), SPSS manual (IBM Corporation, 2012b), and Courtney and Gordon (2013) with one exception. It turned out that R 2.14.2, which is a recommended R version for IBM SPSS Statistics 21, did not work with SPSS 21. Consequently, R 2.14.0 (advised by Dalzell, 2013) was installed. Moreover, SPSS R-dialog requires the following R packages in order to conduct all planned analyses: polycor (Fox, 2010), psych (Revelle, 2013), GPArotation (Bernaards & Jennrich, 2012), nFactors (Raiche & Magis, 2011), corpcor (Schaefer et al., 2012) and ICS (Nordhausen, Oja, & Tyler, 2012).

SPSS R-menu is a brand-new plug-in which has as yet not been widely used and tested (Delzell, 2013). To make sure that relevant PCAs were done properly, and that R-menu actually worked, the results of the first and final PCA were compared to those obtained directly in R.

**Tetrachoric correlations**

Tetrachoric correlations, $r_t$, apply to dichotomous variables that are in reality assumed to represent underlying continuous and normally distributed traits (Cohen & Holliday, 1996; Uebersax, 2011). The calculation of the tetrachoric correlation is the value AD/BC in Figure

4 (Cohen & Holliday, 1996), where the letters most often represent four different ratings. As far as the JVIS items are concerned, the letters reflect different response patterns for two different variables (i.e. A = AA, i.e. respondents selected both alternatives A for both correlated variables, B = BA, i.e. respondents selected alternative B for the first correlated variable, and alternative A for the second one, C = AB, i.e. respondents selected alternative A for the first correlated variable, and alternative B for the second one, and D = BB, if selected statements for both correlated variables were B) (interpretation based on Bartholomew, Steele, Moustaki, & Galbraith, 2008).

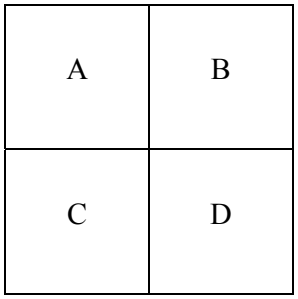


*Figure 4*. An example of a 2x2 table used to calculate tetrachoric correlations, $r_t$ = AD/BC (Cohen & Holliday, 1996).

The polychoric correlations apply to ordinal data. The model for the polychoric correlations is very similar. The difference is that there are more paremeters in the model, corresponding to more (than two) ordered levels (Uebersax, 2011).

**Measures and covariates**

**Student satisfaction.** The degree to which participants were satisfied with their study (i.e. student satisfaction) was divided into two scales: the first one measuring satisfaction with the social environment (*Social Satisfaction*), and the second assessing satisfaction with the academic life (*Academic Satisfaction*).

Social satisfaction items were developed for the purpose of the current study. There were six of them (e.g. ″For the most part, I am satisfied with my student social life″ and ″I am satisfied with the number of student social events″).

Academic satisfaction was based on a seven-item scale developed by Lent, Singley, Sheu, Schmidt, and Schmidt (2007). This scale was previously adapted from Lent et al. (2005). Translation of the academic satisfaction items to Norwegian was based on the same principles as the JVIS translation (see the Translation subsection). The items included: ″For

the most part, I am enjoying my coursework, and ″I like how much I have been learning in my classes″. The estimated internal consistency reliability of the original scale was $\alpha = .94$ (Lent et al., 2007).

Responses to all 13 student satisfaction items were obtained along a 5-point Likert scale, from 1 (*Strongly disagree*) to 5 (*Strongly agree*). To ensure validity and reliability of the scales, all items were factorized in PCA. The results are presented in the Results section.

**The JVIS.** The Norwegian version of the JVIS was constructed in the same manner as the original inventory. The inventory had a forced-choice format consisting of 289 statements A and 289 statements B (e.g. A. ″Making unusual glass vases″ versus B. ″Attending a faculty meeting to decide on textbooks for the coming year″; or A. ″Singing in a musical″, versus B. ″Feeling confident in unfamiliar surroundings″), coded 1 for each alternative A and 2 for each alternative B.

**Other covariates.** Gender was a binary variable coded 0 for men and 1 for women. Study programme, the only obligatory variable to fill out, was a string variable which originally described 84 different programmes of study at the NTNU. Since there were few respondents per each study programme (psychology students constituted the biggest homogenous group, $n = 59$), programmes referring to similar fields of study were combined with one another and coded as uniform categories. As a result, six main student groups emerged (codes are included in the parentheses; all the main students groups will be denoted by capital letters from now on ): Social Science (1), Medical Science (2), The Humanities (3), Natural Science and Mathematics (4), Engineering and Technology (5), and Teacher Education (6). The first group included students majoring in for example psychology, social anthropology, sociology, European studies, or political science. The second group almost exclusively consisted of medical students ($n = 29$). Five respondents were taking Master's Degree in Clinical Health Science and one – the Bachelor's Degree in Human Movement Science. The third group included students majoring in the humanities. Subjects included, for instance, literature, history, archeology, media studies, philosophy, and film and video production. Art and music students were also embedded in that group, because there were too few of them to make a separate group ($n = 5$). The fourth group consisted of respondents majoring in natural sciences, for example biology, geology, biotechnology, physics, and chemistry. Twelve participants in that group studied mathematics. Students attending various engineering and technology classes made up the fifth group. Both computer sciences (e.g.

cybernetics and robotics, or electronics), and technology studies (e.g. marine technology, petroleum engineering, technical geology, and chemical engineering) were included here. The last group consisted of students that chose teacher education as their major. Thirty-one (out of the overall 60) respondents in that group were specializing in natural sciences, twelve in languages, and the rest in history or social sciences.

The number of respondents in each major student group was as follows: $n = 126$ for Social Science, $n = 38$ for Medical Science, $n = 84$ for The Humanities, $n = 75$ for Natural Science and Mathematics, $n = 101$ for Engineering and Technology, and $n = 60$ for Teacher Education.

**Component scores**

Unweighted total component scores were calculated for Academic Satisfaction and Social Satisfaction, as well as for all the 17 JVIS scales. Even though weighted scores are preferable (Field, 2013; Field, Miles, & Field, 2012; Ulleberg & Nordvik, 2000), the choice of unweighted total scores was dictated by practical reasons. Only unweighted factor or component scores are available via SPSS R-menu. Moreover, according to Ulleberg and Nordvik (2000), unweighted total or average scores are also more easily interpretable and most often used in psychological research. Weighted and unweighted factor scores are also often highly correlated, especially when all variables have comparably high factor loadings (Ulleberg & Nordvik, 2000). The negative component loadings were taken into consideration while calculating total scores.

**Reliability estimates**

Reliabilities of all the scales in the study (Academic Satisfaction, Social Satisfaction and the obtained JVIS scales) were assessed by ordinal alpha. Ordinal alpha is conceptually similar to Cronbach's alpha (Cronbach, 1951), but it is based on the tetrachoric or polychoric correlation matrix rather than the Pearson covariance matrix (Gadermann, Guhn, & Zumbo, 2012; Zumbo, Gadermann, & Zeisser, 2007). Cronbach himself argued that the Cronbach reliability estimate was often misused and misinterpreted (Cronbach & Shavelson, 2004). Using Cronbach's alpha can indeed deflate reliability estimates while dealing with data that is not continuous (Maydeu-Olivares, Coffman, & Hartmann, 2007), which consequently may result in discharging a potentially reliable scale as unreliable (Gadermann et al., 2012).

**Treatment of missing data**

As described in Criteria for valid responses, only data from respondents provided an answer to at least that answered at least 279 of the JVIS items (i.e. had a maximum number of 10 missing), was used in the analyses. Only missing responses to the JVIS items were taken into consideration, since missing data for other variables was a minimal problem. Before the main analyses were conducted, the data was analyzed with Little's MCAR test to determine randomness of missing data, that is to check if the missingness did not depend on the values of variables (Little, 1988). Several missing-data methods, including pairwise method, often require the MCAR assumption which means that data is missing completely at random (Little & Rubin, 1989).

There were altogether 237 respondents with incomplete data. The majority of them did not provide a response to one, two, or three JVIS questions. In total, 236 JVIS variables had some missing values. The overall number of missing values was very low, .37% (i.e. 521 values out of 139,839 possible). The MCAR test revealed that the most common pattern of missing data was ″missing completely at random″.

Taking into account a large number of the JVIS items and a relatively small sample size, it was highly desirable to use all the 484 cases in the analyses. Listwise deletion of missing data was actually not an option, since PCA cannot be conducted with more cases than variables. Moreover, a pairwise deletion of missing data can often lead to a non-positive definite correlation matrix (Wothke, 1993). Consequently, PCA or FA does not iterate, and reports an error. To avoid the problem of a non-positive matrix in PCA and to use all the 484 cases, all missing data was substituted with the most frequent value in each variable.

**Testing the hypotheses**

The structure of the Norwegian version of the JVIS was explored using several PCAs. The analyses of the binary JVIS variables were based on polychoric/tetrachoric correlation matrix obtained via SPSS R-menu. As mentioned before, this choice was made based on Basto and Pereira's suggestions (Basto and Pereira, 2012; see also Kubinger, 2003).

Significant mean differences between the six student groups, as postulated by Hypothesis 2, ware tested using one-way ANOVA procedures. Subsequent paired comparisons between the mean score for the six main student groups were done by means of three different *post hoc* tests.

Following Field's recommendation (Field, 2013), several issues were taken into consideration while choosing the *post hoc* tests: sample sizes, the equality of variances, and

control over Type I error. Generally, the Hochberg's GT2 should be used if sample sizes are very different, which was the case in the current study. It is also advisable to select the Games–Howell test if there is any uncertainty of whether the population variances are equal. Finally, the Bonferroni comparisons offer a tight control over the Type I error. Consequently, all three aforementioned post hoc tests were conducted at the same. The results of the Hochberg's GT paired comparisons were reported if the variances were equal and the results of the Games–Howell *post hoc* comparisons if the variances were unequal. Any inconsistencies in the results of the different paired comparisons were highlighted in the Results section. I also reported Welch's *F* (Field, 2013) in there was a problem of inequality of variances in any of the one-way ANOVA procedures.

Hypothesis 3, which refers to the relationship between the JVIS scores and Academic Satisfaction and the Social Satisfaction for each student group, was tested using Pearson's product moment-moment correlation coefficient. Gender differences in vocational interests, asserted by Hypothesis 4, were examined with independent sample t-tests.

The bootstrap method was carried out for all the *post hoc* tests, correlations, and each independent t-test to reduce the impact of potential bias (Field, 2013).

## Results

The Results section starts with the demonstration of the results of the PCA of the student satisfaction items. Results of the tests for the subsequent hypotheses will be presented in the representative subsections.

### Principal components analysis of the student satisfaction items

The Academic Satisfaction scale and the Social Satisfaction scale were estimated by an exploratory PCA performed on the seven Academic Satisfaction items and the six Social Satisfaction items with the oblique rotation (Oblimin Quartmin). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, *KMO* = .86 (meritorious according to Hutcheson & Sofroniou, 1999; Kaiser, 1974). *MSA* – Measures of sampling adequacy for all items were well above .80. Two components had eigenvalues of Kaiser's criterion 1. The scree plot indicated unambiguously that two components should have been retained. Both components in combination explained 69 % of the variance. The first component represented Social Satisfaction and the second Academic Satisfaction. One of the items (″I am comfortable with the educational atmosphere in my major field″) loaded equally high (.45) on both components, and deflated the reliability of both scales. Consequently, it was excluded from the analysis. The remaining 12 items were once again rotated obliquely in a PCA. The obtained scale, had high reliabilities measured by the ordinal coefficient alpha, $\alpha_{alpha}$ = .91 for both Academic Satisfaction and Social Satisfaction. The component loadings, eigenvalues, explained variance and reliability coefficients are reported in Table C1 in Appendix C.

### Hypothesis 1: The structure of the Norwegian version of the JVIS will be similar to the structure of the American version of the inventory.

All the 289 variables of the JVIS were explored for underlying patterns in PCA. Variables were rotated with Oblimin Quartimin to obtain oblique components. Stevens (2002) recommends to treat component loadings greater than .40 (i.e. explaining 16% of the variance in the variables) as meaningful. Some researchers opt for the lower criterion of .30+ (Field, 2013; Ulleberg & Nordvik, 2000). I decided to take a pragmatic approach by treating component loadings at least as high as .35 as meaningful.

The initial analysis showed inconsistent results as to how many components should have been retained. There were as many as 68 components with eigenvalues over Kaiser's criterion of 1. Since the objective of the analysis was to reduce the number of variables to meaningful variable clusters, Kaiser's criterion was not taken into consideration. The scree

plot also gave ambivalent results. It showed, though unclearly, inflections that would justify retaining 15, 16, or 25 components. Even though scree plot was equivocal, it indicated retaining much fewer components than Kaiser's criterion. Consequently, it was regarded more useful for further exploration. To cross-check the results of the Scree plot, a parallel analysis (Horn, 1965) (available via SPSS R-menu), based on the tertrachoric/polychoric correlation matrix, was conducted. Parallel analysis is generally regarded as a superior method for determining the number of factors to retain (Field, 2013; Field, Miles, & Field, 2012). The parallel analysis results signalled that 26 components should have been retained. Accordingly, the 289 variables were rotated obliquely once again, but the number of 26 components was specified in the SPSS dialog box. Reliability check of 26 components was done simultaneously.

The results revealed that omitting some variables could improve reliabilities of some components. The verification of the component structure and the maximization of scale reliability and validity followed the stepwise approach postulated by Wille (1996, as cited in Raubenheimer, 2004). In the first step, scales' reliabilities were maximized by the stepwise removal of the least reliable items. Components that both consisted of one item or two items, and had very low reliabilities were also, one by one, removed from the further analyses. Variables that loaded on more than one component were examined in a second step. If their loadings on two or more components were equally high, they were not included in the further analyses. However, the problem of variables loading highly on the same component was practically negligible. In a third step, variables that did not load highly on any component (< .35) were identified and omitted from further analyses in a stepwise fashion. New parallel analysis and PCA were run each time new variables were omitted.

Seventeen meaningful components were retained in the final PCA. Those components explained 61.88% of variance in all the remaining 221 variables. All components had ordinal reliabilities over .70.

The eigenvalues, variances, and reliability coefficients are reported in Table 1. Because of the large number of the JVIS variables used in the analyses, only the number of items, as well as the maximums and minimums of the component loadings for each component or scale are presented in Table 1. Furthermore, in accordance with the copyright agreement with Sigma Assessment Systems, variable labels are not revealed (see also the Method section). However, I have provided examples of items along with the detailed descriptions of the obtained components.

Table 1

*Summary of the Pattern Matrix for the Principal Components Analysis of the Norwegian Version of the Jackson Vocational Interest Survey*

| Scale (A- or B-component) | Number of items | Component loadings | | Eigenvalues | % variance | $\alpha_{ordinal}$ |
|---|---|---|---|---|---|---|
| | | *Min* | *Max* | | | |
| Mathematical Reasoning (A) | 24 | .36 | .82 | 30.67 | 13.88 | .96 |
| Performing Arts (A) | 14 | .43 | .71 | 20.05 | 9.07 | .87 |
| Writing (B) | 15 | .46 | .70 | 14.42 | 6.62 | .91 |
| Medical Service (A) | 17 | –.38 | –.74 | 11.98 | 5.42 | .92 |
| Adventure (A) | 16 | .42 | .70 | 9.21 | 4.17 | .89 |
| Interpersonal Confidence (B) | 5 | –.44 | –.75 | 6.71 | 3.04 | .71 |
| Natural Science (A) | 26 | .39 | .65 | 6.28 | 2.84 | .95 |
| Professional Advising (B) | 5 | –.39 | –.62 | 5.67 | 2.57 | .75 |
| Teaching (B) | 10 | –.41 | –.63 | 4.98 | 2.26 | .79 |
| Accountability–Independence (AB) | 4 | .52 | .79 | 4.57 | 2.07 | .73 |
| Stamina (A) | 9 | .41 | .61 | 4.09 | 1,85 | .79 |
| Social Science (A) | 10 | –.37 | –.65 | 3.35 | 1.52 | .82 |
| Dominant Leadership (A) | 12 | .35 | .68 | 3.23 | 1.46 | .79 |
| Social Service (B) | 11 | –.39 | –.69 | 3.14 | 1.42 | .89 |
| Creative Arts (A) | 16 | .39 | .69 | 2.93 | 1.33 | .91 |
| Practical Activities–Conventional Activities (AB) | 14 | –.35 | –.74 | 2.88 | 1.30 | .89 |
| Job Security (A) | 13 | .41 | .71 | 2.60 | 1.18 | .84 |

*Note.* Component loadings ≥ .35

**The problem of non-positive definite correlation matrix**

The problem of non-positive definite correlation matrix appeared in every single PCA of the JVIS items. Consequently, several possible causes of the positive-definiteness were considered.

Firstly, pairwise deletion of missing data can cause the indefiniteness problem (Wothke, 1993). As described in the Method section, the problem was dealt with by replacing missing data with the most frequent value in each variable.

Secondly, when a sample is small, and a number of variables large, a correlation matrix may be non-positive definite due to mere sampling fluctuations (Anderson & Gerbing, 1984). Collecting more data was naturally not possible in a relatively short period of time devoted to the current study.

Thirdly, linear dependencies or collinearities (singularity or multicollinearity) can also lead to non-positive definite correlation matrices (Wothke, 1993). The obtained correlation matrices did not reveal any variables that correlated very highly ($r > .80$). However, since the correlation matrices in the current study were very big (the largest consisted of 289 x 289 variables), the problem might just as well have been caused by several variables correlating much lower than .80 (e.g. $r = .60$) (Field, 2013; Field et al., 2012). Multicollinearity or singularity should be avoided in FA, but it does not cause great problems for PCA (Field, 2013; Field et al., 2012). PCA is in fact often used to diagnose the problem of linear dependencies before conducting other analyses (e.g. regression analyses) (Field, 2013; Field et al., 2012).

Lastly, using tetrachoric or polychoric correlations, especially with a large number of variables, may yield input correlation matrices that are not positive definite (Wothke, 1993). Positive definiteness is here a property of eigenvalues of correlation matrices. If the original matrix has many zero or negative eigenvalues, it will most certainly be non-positive definite (Higham, 2002). Decomposing matrix into eigenvalues and replacing negative eigenvalues with positive values can help to solve the problem (Ridgon, 1997). The problem did not persist when a matrix of Pearson's correlations was computed, which could indicate that tetrachoric correlations were the main problem (Ridgon, 1997). However, if the *polycor* R-package (Fox, 2010) is installed, R will make an attempt to adjust the matrix to a positive-definite matrix, using *nearcor* function via the *sfsmisc* package (Maechler et al., 2012). The function implements the algorithm of Higham (2002). The package smooths the matrix by forcing symmetry, and then by replacing negative or ″almost zero″ eigenvalues with positive

eigenvalues. Consequently, all the obtained non-positive definite correlation matrices were adjusted to positive definite by means of the *nearcor* function in R.

**Singular $R_t$-matrix**

The problem of singularity of $R_t$ (tetrachoric) matrix appeared in the PCAs of the JVIS items. Singularity indicated that the correlation matrix was not an identity matrix, that is, the variables were correlated highly enough to conduct a PCA. The determinant of the $R_t$ matrix was 0. As described in the previous subsection, the problem of singularity is not critical in PCA (Field, 2013; Field et al., 2012).

The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, *KMO* = .91 (marvellous according to Hutcheson & Sofroniou, 1999; Kaiser, 1974). *MSA* – Measures of sampling adequacy for all items were well above .70. However, since the matrix could not be inverted (i.e. due to the determinant of 0), the estimation of the *KMO* was based upon the observed correlations (see Kaiser, 1970).

**Retained components**

All the variables consisted of two statements, so the obtained 17 components were bipolar. It turned out that almost all components gave the most meaningful interpretations only if statements A or only statements B of each component were taken into consideration. If statements A produced a meaningful component, I would consequently call them A-items, and their clusters – A-components or A-scales (used interchangeably). If, on the other side, several statements B constituted a component, I would name them B-items, and their final components – either B-components or B-scales. The opposite pole of each A- or B-component mostly consisted of items referring to very different job-related activities. Those scales were often difficult to interpret as meaningful and unambiguous entities. The descriptions of each of them are provided below, but those descriptions should be treated as *rough* interpretations. Moreover, the only meaningful bipolar components were components 10 and 16, because both poles of those components allowed a clear interpretation.

**Component 1 – Mathematical Reasoning.** The first A-component, which consists of 24 A-items, and accounts for almost 14 % of variance in the data, represents a preference for working with mathematical formulas and quantitative concepts. It is very similar to the Mathematics scale in the original inventory. In fact, it contains 16 A-items from the original Mathematics scale (e.g. ″explaining the applications of trigonometry to navigation″ or

″«playing» with algebra problems″). The remaining eight A-items are originally a part of the Physical Science and Engineering scales. Nevertheless, they indicate an interest in activities requiring logical thought and adopting mathematical, logical and systematical methods to practical problems (e.g. in engineering design process or in research design). The A-component has thereafter been called Mathematical Reasoning. Taking into consideration the general occupation themes of the JVIS, the A-component represents the Logical cluster. Additionally, in the light of Holland's model, it represents the Investigative type. The component loadings range from .36 to .82.

The other pole highlights the practical arts of day-to-day interaction with people in a context where persuasive, instructional, and advisory motives predominate (e.g. selling, business, legal activities). People salient on that scale would seek situations that involve a high degree of self-confidence, planfulness and good social skills. Examples of activities include ″representing a large organization″ and ″presenting a budget analysis″. Moreover, the B-pole refers to an interest in teaching and social service activities (e.g. ″preparing lectures″ and ″collecting clothing for needy families″). In Jackson's terms, it could be called Enterprising/Helping. Enterprising/Social is the most proper description if one was to refer to Holland's types.

**Component 2 – Performing Arts.** The second A-component represents a preference for activities that involve performing for an audience, either as a musician or an actor. The scale consists of 14 A-items (with the component loadings from .43 to .71) that are all a part of the Preforming Arts scale in the original JVIS, for instance, ″playing a main part in a low-budget movie″ or ″rehearsing with a band″. The A-component is also a representative example of the Expressive occupational theme, or the Artistic vocational personality.

The B-pole is similar to the Enterprising theme of the first component. It encompasses activities which require a high level of self-confidence and good interpersonal skills, for example, in business, professional advising or law. Statements describing activities, such as ″working as an assistant for a top leader″, ″participating in an advisory committee″, and ″representing a client against an insurance company″, belong to the B-pole.

**Component 3 – Writing.** The third B-component could generally be described as ″a liking for writing". It consists of 15 B-items with the component loadings in the range from .46 to .71. The scale refers to activities that are about producing imaginative and creative writings, as well as technical and factual reports. The scale is actually very similar to the

original Author–Journalism scale (e.g. ″bring characters to life in a novel″), even though three B-items comes from the Technical Writing scale (e.g. ″writing historical introductions for books″). Consequently, it has been given a general name Writing. The B-component belongs to the Communicative and the Expressive occupational theme. With reference to Holland's typology, it represents the Artistic vocational personality.

The other pole represents activities related to family life (e.g. shopping) and skilled trades (e.g. ″polishing contact lenses″). Working with concrete things will probably be the least ambiguous description of this component. It also seems closest related to the general occupational theme Practical of the JVIS, or the Realistic type of the RIASEC classification.

**Component 4 – Medical Service.** The A-items that clustered on this A-component clearly refer to an interest in medical and health care. This particular scale is in fact identical to Medical Service of the American version of the JVIS. Seventeen items have the component loadings varying from –.38 to –.74. The items describe activities related to promoting health by treating and curing people. The Examples of A-items include ″drawing blood form patients″ and ″performing surgery″. According to Jackson (2000), Medical Service represents the Inquiring general occupational theme. Using Holland's terminology, it is possible to regard the scale as a reflection of the Investigative type.

Alternatives B indicate a preference for organizing and planning different activities (e.g. ″arranging to finance a mutual fund″ or ″organizing recreational activities for patients″). They also refer to job-related activities that involve offering professional advice on different topics (e.g. ″aiding toy manufacturers with information on buying trends″) or influencing people in some fashion (e.g. ″supervising an employee's work″). Again, the scale is more or less an equivalent to the Enterprising occupational theme or the Enterprising vocational type.

**Component 5 – Adventure.** The fifth A-component is about enjoying novel, unusual or dangerous situations. It consists of 16 items from the original Adventure scale, for instance ″teaching climbing″ and ″sky diving″. The lowest component loading is .42, the highest .70. Adventure is not listed among any of Jackson's general occupational themes.

The B-pole represents vocational interests in professional advising, supervision and office work. It is also about being self-confident, independent and ambitious while working on a specific task. Enterprising is again the best label for that pole.

**Component 6 –Interpersonal Confidence.** The sixth B-component consists of five B-items that belong to Interpersonal Confidence in the original JVIS. The component loadings vary with the limit of –.44 and –.75. The scale indicates a preference for working in environments that require frequent interaction with others, and a high level of self-confidence in social contexts (e.g. ″talking easily with others″). In accordance with Jackson's and Holland's terms, it represents a preference for the Enterprising mode of behaviour, and the Social environment, respectively.

The A-items mainly refer to traditional and practical activities (e.g. ″servicing appliances″ and ″being conservative in the career choice″). The scale matches well the general Practical theme of the JVIS, or the Realistic type in the Holland's hexagon

**Component 7 – Natural Science.** The seventh A-component has been called *Natural Science*. It is a mixture of A-items from the Life Science scale (15 items) and the Physical Science scale (10 items) of the original JVIS, with the lowest component loading of .39, and the highest of .65. The Natural Science scale indicates a preference for systematic investigation of both living and non-living nature. Examples include ″studying the structure of the eyes of frogs″ and ″predicting the movement of a comet″. One A-item (i.e. ″protecting crops from insects and disease″) is originally a part of the Nature–Agriculture scale. However, it fits well in the context of natural sciences. A high degree of intellectual curiosity, as represented by the Inquiring theme, as well as a willingness to undertake prolonged intellectual activity, as reflected by the Logical theme, are meaningful interpretations of that scale. Similar to Mathematical Reasoning, it also matches Holland's Investigative type.

The other pole is very equivocal. On the one hand, it is very similar to the B-pole of the first component, that is, Enterprising/Helping (i.e. a preference for activities in sales, finance, law, and teaching), for instance, ″providing budget analysis″, ″preparing a testament for a client″, or ″choosing textbooks for a history class″. On the other hand, it indicates a preference for expressing ideas in a written form and for working in an academic environment (e.g. ″writing a research paper″). Based on Jackson's classification, the B-pole represents the Enterprising, Helping, and Communicative occupational theme. The Enterprising/Artistic type is the most proper name for that B-component if one is to use Holland's terms.

**Component 8 – Professional Advising.** The eight B-component consists of items that are a part of Professional Advising, Finance, and Human Relations Management in the American version of the JVIS. It highlight an interest in giving expert advice on various topics, for instance, ″leading a political campaign″, ″establishing a company budget″, or ″protesting unfair work policy″. Thus the B-scale is called Professional Advising. The component includes five B-items with the component loading as low as –.39, and as high as –.62.

When it comes to the A-pole, three items are about providing service to customers (e.g. in a beauty shop or in a training center), while the other two relate to doing social science research and enjoying domestic activities (″painting a child's room″).

**Component 9 – Teaching.** The ninth B-component represents an affinity for teaching, especially at the elementary level. The scale is to a great extent an equivalent to Elementary Education (e.g. ″teaching simple subject to young children″), even though two B-items belong to the Teaching scale in the original test (i.e. ″organizing field trips for students″), and one to the Social Service scale (i.e. ″conducting workshops for disabled children″). Since all items are about teaching or organizing educational activities, the scale has been labelled Teaching. The component is similar to the Helping occupational theme in the JVIS, and the Social type in the RIASEC model. It consists of 10 B-items, each of which has the component loadings in the range of –.41 to –.63

The other pole generally refers to Practical or Realistic activities (e.g. ″having a vegetable farm″, and ″taking family on a trip″), where traditional values, such as closeness to family or nature, and well-established techniques are the standard.

**Component 10 – Accountability–Independence.** The A-items represent a preference for work environments that refer to traditional values of reliability, engagement and responsibility (e.g. ″getting involved in one's work″ and ″remembering to return borrowed things on time″). Accountability is a part of the Socialized general occupational theme.

The B-items indicate an interest in vocational environments free of close supervision, but requiring a high degree of independence in problem solving and decision-making. Independence belongs to the Assertive general occupational theme.

Component 10 consists of four A-items and four B-items with the component loadings from .52 to .79. It is the first component in which both statements A and B can be interpreted meaningfully, and with a reference to the original JVIS scales.

**Component 11 – Stamina.** The eleventh A-component clearly describes Stamina. It highlights a preference for a work style that is characterized by a willingness to work on a task for long hours and under pressure (e.g. ″working longer hours than required″). It also represents an inclination to work on challenging assignments. Nine A-items belonging to that scale have the component loadings of minimum .41 and maximum .61. Stamina is a part of the Socialized general occupational theme in Jackson's classification.

The other pole again refers to activities involving persuasion, advising and supervision. Examples include ″supplying drug stores″ and ″leading an expert panel″. It represents Enterprising vocational interests.

**Component 12 – Social Science.** Component 12 stands for interest in social sciences. It describes enthusiasm for investigating and learning about various aspects of society, human behaviour and social interaction (e.g. ″studying religious attitudes of different cultural groups″ or ″analyzing the effects of group pressure on an individual's action″). Ten A-items come from the Social Science scale. It also represents the Inquiring theme, as well as the Investigative vocational personality type. The component loadings range from –.37 to –.65.

The B-pole is mostly about dealing with people in counselling or conflict situations. To a great extent, it has to do with professional advising and human relation management. It also refers to activities requiring a high degree of self-confidence and good interpersonal skills. The item examples are as follows: ″interviewing candidates for an important position″, ″having management responsibilities in a company″, or ″being self-confident while learning a new task″. It reflects Enterprising vocational interests in both Jackson's general categorization and in Holland's typology.

**Component 13 – Dominant Leadership.** Component 13 consists of 12 A-items that describe dominant leadership style. The component loadings vary within a limit of .35 to .68. The A-scale is about enjoying having a position of authority, supervising others and keeping discipline in a workplace. It is an equivalent to the Dominant Leadership scale, though with fewer items. It is also best described by the general Assertive theme, or the Enterprising vocational personality.

Alternatives B indicate an interest in working with people. Similar to the B-pole of the first component, the B-items describe activities that presuppose helping, teaching, counselling, or exerting influence on others. However, they also represent an interest in

activities that require accuracy and independence. The B-pole could roughly be called Enterprising/Helping.

**Component 14 – Social Service.** Social Service is a proper name for the next B-component. It consists of 11 items (with the component loadings from –.39 to .–69) which belong to Social Service in the original test. The scale is concerned with a preference for helping people cope with their problems and disabilities (e.g. ″working with psychiatric patients″ and ″helping alcoholics with their problem″). Taking into consideration Jackson's and Holland's theory, Helping and Social could be treated as more general descriptions of this component.

The A-pole is very ambiguous. In fact, it is very difficult to give it a name that would encapsulate all aspects of all statements belonging to it. In consists of job activities that could be a part of an artistic and engineering job (e.g. creative and industrial design), or a leader career (e.g. ″giving orders″). Moreover, activities concerned with personal service (e.g. ″guiding tourists″) or family life (e.g. ″cleaning a family garden″) also constitute that pole.

**Component 15 – Creative Arts.** The fifteenth A-component represents an interest in designing and producing aesthetically pleasing things. It highlights a preference for activities in both applied and fine arts. Thirteen A-items originate from the Creative Arts scale (e.g. ″modelling with clay″ and ″designing jewellery″), and three from the Skilled Trades scale (i.e. ″using a machine to make laces″ and ″making draperies″). The component loadings vary from .39 to. 69. The A-scale reflects the Expressive occupational theme and the Artistic type in a similar fashion to Performing Arts and Writing.

The opposite pole is similar to the Enterprising theme. Vocational interests in dealing with people in order to persuade or influence them (e.g. ″convincing a company board to do something and leading the sales campaign″) are a common denominator of that pole.

**Component 16 – Practical Activities–Conventional Activities.** The A-component describe activities that involve working with tools and machines, often outdoors. On the other hand, the B-pole describes job-activities related to solving business and financial problems, and working with administrative tasks. Fourteen A and B-items has the component loadings within the limit of –.35 to –.74.

While items from both Nature-Agriculture (e.g. ″raising flowers″) and Skilled Trades (e.g. ″laying the tiles″) are a part of the A-pole, the B-pole consists of statements associated with interests valued in commerce, such as Finance (e.g. ″buying business securities″),

Business (e.g. ″arranging for competitive bids″) and Office Work (e.g. ″writing business letters″). Both poles of the eighth components are meaningful and easily interpretable. Following Jacksons' classification of occupational themes, Practical Activities–Conventional Activities have been treated the best name for that component. The scales also reflect the Realistic and the Conventional corner of the RIASEC hexagon.

**Component 17 – Job Security.** The last A-component is about preferring occupations that are characterized by a high degree of security and predictability. The scale refers to a work style that implies avoiding social and economic risk in a workplace. Examples of A-items are ″avoiding challenges that can lead to a job loss″ and ″choosing a job with a foreseeable future″. This component is a Norwegian counterpart to the Job Security scale in the original version of the test. It includes 13 A-items with the component loadings of .41 to .71.

The B-pole is non-different from the B-pole of the second component. It refers to a preference for activities involving influencing or persuading others, such as selling products, supervising employees or giving advice to clients. Consequently, it reflects the Enterprising theme in the JVIS, and the Enterprising type in Holland's typology.

**Component scores revisited**

The scores were calculated by assigning all variables constituting each meaningful A or B-component value 1, and all items on the other ″less meaningful pole″ value 0. Consequently, the A-items belonging to Mathematical Reasoning, Performing Arts, Medical Service, Adventure, Natural Science, Stamina, Social Science, Dominant Leadership, Creative Arts, and Job Security were coded 1, while the items of the other pole 0. B-items which made up Writing, Interpersonal Confidence, Professional Advising, Teaching, and Social Service were coded 1, and the opposite items 0. When it comes to Accountability–Independence, and Practical Activities–Conventional Activities, statements describing Accountability and Practical Activities were assigned value 1, whereas statements B referring to Independence, and Conventional Activities value 0. A high score on a specific A or B-scale was equivalent to a low score on the other pole, and conversely, a low score on a particular A or B-component corresponded with a high score on the opposite scale.

The intercorrelations, means, and standard deviations for the scores on all the 17 scales, are included in Table C2 in Appendix C. The same table also includes the coefficients for the correlations between the Norwegian JVIS scores and the student satisfaction scales in the whole sample.

**Hypothesis 2: The six student group will show the strongest interest in activities represented by the JVIS vocational interest scale that is closest related to their field of study.**

With reference to the obtained JVIS scales, the group majoring in social sciences will be most interested in activities belonging to Social Science. The medical students will show the strongest preference for activities in Medical Service. Both the group majoring in natural sciences and mathematics, and in engineering and technology, will show the strongest preference for activities represented by Mathematical Reasoning. There will be the strongest preference among the humanists for activities in Creative Arts, Performing Arts, and Writing. An interest in Natural Science will be strongest for the natural science and math students. Finally, the student teachers will demonstrate the strongest interest in teaching activities.

The vocational interest level is indicated by mean scores on the Norwegian JVIS scales. The minimum values, maximum values, means, and standard deviations for scores on the 17 JVIS scales for each of the six student groups are reported in Table C3 in Appendix C.

Only bootstrap 95 % confidence intervals for the mean scores are reported below. However, it is important to stress that none of the significant mean differences for different *post hoc* comparisons crossed zero.

**One-way ANOVA for Social Science**

A one-way ANOVA showed that vocational interests represented by the Social Science scale differed significantly across all the student groups, $F(5, 478) = 6.73$, $p < .001$. The Hochberg's GT *post hoc* comparisons of the six groups indicated that the social science group gave significantly higher preference ratings than both the medicine students, $p = .003$, and the engineering students, $p < .001$. The mean score comparisons for the students majoring in social sciences, and the other three groups, that is, the humanists, the natural science and math students and the student teachers, were not statistically significant, $p > .05$ in all cases. The Hochberg's GT results were confirmed by the Bonferroni *post hoc* procedure and the Games–Howell procedure.

All in all, the 126 participants majoring in social sciences were more interested in Social Science activities than the medical students and the engineering students. Vocational interests reflected by the same scale were, however, equally strong among the four student groups: Social Science, Humanities, Natural Science and Mathematics, and Teacher Education. The means and standard deviations of the scores on Social Science are reported in Table 2.

Table 2

*Means and Standard Deviations of Scores on the JVIS Social Science Scale for the Six Student Groups*

| | Student groups | | | | | |
|---|---|---|---|---|---|---|
| | Social ($n$ = 126) | Medical ($n$ = 38) | Humanities ($n$ = 84) | Natural/Math ($n$ = 75) | Engineering ($n$ = 101) | Teacher ($n$ = 60) |
| *M* | $6.51_a$ [6.07, 6.97] | $4.89_c$ [4.11, 5.77] | $5.94_a$ [5.42,6.45] | $6.43_a$ [5.97, 6.88] | $5.05_e$ [4.54, 5.52] | $5.87_a$ [5.33, 6.37] |
| *SD* | 2.43 | 2.41 | 2.43 | 2.13 | 2.36 | 1.87 |

*Note.* Means with subscripts different than a are significantly different from the mean of the Social Science at $p$ <.01 based on the Hochberg's GT2 *post hoc* paired comparisons. Bootstrap 95% Confidence Intervals are reported in brackets.

**One-way ANOVA for Medical Service**

A one-way ANOVA was conducted to compare the mean scores on Medical Service for the six student groups. There was a significant difference in vocational interests at the $p < .001$ across the groups, $F(5, 478) = 23.04$. The Hochberg's GT2 *post hoc* comparisons revealed that the mean score of the medical students was significantly higher than that of any of the other five student groups, $p < .001$ for the five comparisons. The results were substantiated by the Bonferroni *post hoc* test and the Games–Howell *post hoc* test.

Taken together, the medical students showed the strongest preference for activities in health and medical care. The means and standard deviations for scores on the Medical Service scale for all the student groups are presented in Table 3.

**One-way ANOVA for Creative Arts**

There was a statistically significant difference in mean scores on Creative Arts between the student groups, as determined by a one-way ANOVA, $F(5, 478) = 5.17$, $p <$ .001. As showed in Table 4, the humanists had the second highest score, whereas the natural scientist and mathematicians had the highest score. The Hochberg's GT2 *post hoc* test revealed that the mean score differences between students majoring in the humanities and any other of the five student groups, was not statistically significant, $p > .05$. The mean difference was significant for the social science students, $p = .001$, the medicine students, $p = .012$, and the engineering students, $p = .002$, while compared to the natural science and math group.

The results indicated that the group of natural science and math students was more interested in creative and artistic activities than the students in social sciences, medicine, and engineering and technology. The preference for activities in Creative Arts among the humanists was as strong as for any of the other student groups.

Table 3

*Means and Standard Deviations of Scores on the JVIS Medical Service Scale for the Six Student Groups*

| | Student groups | | | | | |
|---|---|---|---|---|---|---|
| | Social ($n$ = 126) | Medical ($n$ = 38) | Humanities ($n$ = 84) | Natural/Math ($n$ = 75) | Engineering ($n$ = 101) | Teacher ($n$ = 60) |
| *M* | $7.53_a$ [6.79, 8.25] | $14.05_b$ [12.80, 15.10] | $6.10_c$ [5.27, 6.93] | $9.89_d$ [8.80, 10.97] | $7.51_e$ [6.79, 8.36] | $7.90_f$ [6.87, 8.84] |
| *SD* | 4.22 | 3.43 | 3.82 | 4.49 | 4.27 | 4.32 |

*Note.* Means with subscripts other than b are significantly different from the mean of the Medical Studies at the $p < .001$ based on the Hochberg's GT2 *post hoc* paired comparisons. Bootstrap 95% Confidence Intervals are reported in brackets.

Table 4

*Means and Standard Deviations of Scores on the JVIS Creative Arts Scale for the Six Student Groups*

| | Student groups | | | | | |
|---|---|---|---|---|---|---|
| | Social ($n$ = 126) | Medical ($n$ = 38) | Humanities ($n$ = 84) | Natural/Math ($n$ = 75) | Engineering ($n$ = 101) | Teacher ($n$ = 60) |
| *M* | $5.94_c$ [5.28, 6.54] | $5.63_c$ [4.42, 6.35] | $7.42_c$ [6.50, 8.25] | $8.25_c$ [7.23, 9.22] | $5.96_c$ [5.25, 6.71] | $6.70_c$ [5.82, 7.60] |
| *SD* | 3.65 | 4.42 | 3.93 | 4.10 | 3.40 | 3.60 |

*Note.* Means with subscripts denoted c are *not* significantly different from the mean of the Humanities based on the Hochberg's GT2 *post hoc* paired comparisons. Bootstrap 95% Confidence Intervals are reported in brackets.

**One-way ANOVA for Performing Arts**

There was a statistically significant differences in a preference for activities in Performing Arts across the six student groups, $F_{Welch}(5, 180.67) = 9.74$, $p < .001$. The Games–Howell *post hoc* multiple comparisons showed that the preference was strongest for the Humanities, when the group's mean score was examined against that of Social Science ($p = .002$), Natural Science and Mathematics ($p = .020$), Engineering and Technology ($p < .001$), and Teacher Education ($p = .001$). The mean score difference between the humanists and the medical students, was not statistically significant, $p = .054$, which suggested that both groups were equally interested in activities represented by Performing Arts. The results were supported by both the Hochberg's GT2 and the Bonferroni *post hoc* tests.

The means and standard deviations for scores on the Medical Service scale for all student groups are presented in Table 5.

Table 5

*Means and Standard Deviations of Scores on the JVIS Performing Arts Scale for the Six Student Groups*

| | Student groups | | | | | |
|---|---|---|---|---|---|---|
| | Social ($n$ = 126) | Medical ($n$ = 38) | Humanities ($n$ = 84) | Natural/Math ($n$ = 75) | Engineering ($n$ = 101) | Teacher ($n$ = 60) |
| *M* | $5.24_a$ [4.60, 5.87] | $5.32_c$ [4.42, 6.35] | $7.17_c$ [6.49,7.82] | $5.39_d$ [4.60, 6.24] | $3.96_e$ [3.47, 4.48] | $4.78_f$ [3.91, 5.70] |
| *SD* | 3.70 | 3.17 | 3.50 | 3.48 | 2.65 | 3.32 |

*Note.* Means with subscripts different than c are significantly different from the mean of the Humanities at $p < .05$ based on the Games–Howell *post hoc* paired comparisons. Bootstrap 95% Confidence Intervals reported are in brackets.

**One-way ANOVA for Writing**

A one-way analysis of variance showed that the mean differences in scores on Writing was statistically significant when all student groups were compared to one another, $F(5, 478) = 26.56$, $p < .001$. The *post hoc* analyses using the Hochberg's GT2 criterion for significance indicated that the mean score of the humanists was significantly higher than that of the other five student groups, $p < .001$ for the five comparisons. The interest in producing literary works and technical reports was the most prominent for the Humanities. The results were

confirmed by the other two *post hoc* procedures: the Bonferroni and Games–Howell tests. The means and standard deviations for all groups are reported in Table 6.

Table 6

*Means and Standard Deviations of Scores on the JVIS Writing Scale for the Six Student Groups*

| | Student groups | | | | | |
|---|---|---|---|---|---|---|
| | Social ($n$ = 126) | Medical ($n$ = 38) | Humanities ($n$ = 84) | Natural/Math ($n$ = 75) | Engineering ($n$ = 101) | Teacher ($n$ = 60) |
| *M* | $8.40_a$ [7.78, 9.01] | $7.05_b$ [5.97, 8.26] | $10.55_c$ [9.79,11.2] | $5.67_d$ [4.89, 6.33] | $5.10_e$ [4.38, 5.76] | $6.50_f$ [5.50, 7.47] |
| *SD* | 3.49 | 3.59 | 3.51 | 3.68 | 3.64 | 4.13 |

*Note.* Means with subscripts different than c are significantly different from the mean of the Humanities at $p$ <.001 based on the Hochberg's GT2 *post hoc* paired comparisons. Bootstrap 95% Confidence Intervals are reported in brackets.

**One-way ANOVA for Mathematical Reasoning**

The mean scores on Mathematical Reasoning differentiated significantly across the six student groups, $F_{Welch}(5, 177.78) = 49.56$, $p < .001$. As showed in Table 7, the engineers had the highest score and the natural scientists the second highest score. Those scores were not significantly different from each other, $p > .05$.

Multiply comparisons based on the Games–Howell *post hoc* test revealed that there were statistically significant mean differences between the group of natural science and math students and both the social science group, and the humanities group, $p < .001$ for both comparisons. The mean differences between the group of natural science and math students and the other three groups were not statistically significant, $p = .358$ for the comparison with the medical students, $p = .508$ for the comparison with the engineering students, and $p = .081$ for the comparison with the student teachers.

When it comes to *post hoc* comparisons for the group of the engineering students, the Games–Howell procedure showed that only the group of natural science and math students did not have a significantly different mean from the reference group. The other four groups differed significantly in their mean scores from the engineers, $p < .001$ for the comparison with the social science students, the students in the humanities, and the student teachers, and

$p$ = .008 for the comparison with the medical students. The results were very similar for the Bonferroni procedure and the Hochberg's GT2 procedure.

Everything being taken into account, the students majoring in engineering and technology, as well as in natural sciences and mathematics enjoyed working with quantitative formulas and methods more than the groups in social sciences and the humanities. As long as the two other student groups were concerned (i.e. the medical students and the student teachers), only engineers showed a higher preference for activities in Mathematical Reasoning than those groups. The natural science students, the medical students and the student teachers seemed equally interested in Mathematical Reasoning.

Table 7

*Means and Standard Deviations of Scores on the JVIS Mathematical Reasoning Scale for the Six Student Groups*

| | Student groups | | | | | |
|---|---|---|---|---|---|---|
| | Social ($n$ = 126) | Medical ($n$ = 38) | Humanities ($n$ = 84) | Natural/Math ($n$ = 75) | Engineering ($n$ = 101) | Teacher ($n$ = 60) |
| *M* | 7.70 [6.75, 8.77] | 13.16 [11.36, 15.02] | 8.46 [7.09, 9.66] | 15.48 [14.13, 16.98] | 16.95 [15.95, 17.86] | 12.57 [10.84, 14.16] |
| *SD* | 5.25 | 5.76 | 5.75 | 6.05 | 4.77 | 6.33 |

*Note.* Bootstrap 95% Confidence Intervals reported in brackets.

**One-way ANOVA for Natural Science**

The results of a one-way ANOVA showed that there were significant differences in mean scores on Natural Science between the groups, $F_{Welch}(5, 178.41) = 35.72$, $p < .001$. Table 8 shows that the group of the students majoring in natural sciences and mathematics scored highest. According to the results of the Games–Howell *post hoc* paired comparisons, the mean differences between the group of natural science and math students and all the remaining groups were statistically significant, $p < .001$ for the five comparisons. The results were supported by the Bonferroni test and the Hochberg's test.

All things considered, vocational interests represented by the Natural Science scale were strongest for the students majoring in natural sciences and mathematics.

Table 8

*Means and Standard Deviations of Scores on the JVIS Natural Science Scale for the Six Student Groups*

| | Student groups | | | | | |
|---|---|---|---|---|---|---|
| | Social ($n$ = 126) | Medical ($n$ = 38) | Humanities ($n$ = 84) | Natural/Math ($n$ = 75) | Engineering ($n$ = 101) | Teacher ($n$ = 60) |
| *M* | $9.31_a$ [8.42, 10.38] | $13.16_b$ [11.43, 14.83] | $10.26_c$ [9.02, 11.67] | $18.81_d$ [17.47, 20.07] | $15.37_e$ [14.29, 16.30] | $13.12_f$ [11.39, 14.82] |
| *SD* | 5.44 | 5.83 | 6.00 | 5.48 | 5.09 | 6.81 |

*Note.* Means with subscripts different than d are significantly different from the mean of the Natural Science at $p$ <.001 based on the Games–Howell *post hoc* paired comparisons. Bootstrap 95% Confidence Intervals are reported in brackets.

**One-way ANOVA for Teaching**

The last one-way ANOVA revealed that the mean scores on Teaching across the six groups differed significantly, $F_{Welch}(5, 182.49) = 13.95$, $p < .001$. The Games–Howell *post hoc* paired comparisons revealed that the mean score of the student teachers (see Table 9) was significantly higher than that of any of the other student groups. The p-values were respectively, $p = .020$ for the comparison with Social Science, $p = .019$ for the comparison with Medical Science, and $p < .001$ for the comparisons with the Humanities, Natural Science and Mathematics, and Engineering and Technology. However, the results of the Bonferroni and the Hochberg's GT2 tests were not statistically significant when the group of teacher students was compared with the social science students and the medical students, $p > .05$.

All in all, the student teachers showed the strongest preference for teaching. However, the results of the comparisons between the student teachers and both the social science group studying and the medical science group were inconclusive.

Table 9

*Means and Standard Deviations of Scores on the JVIS Teaching Scale for the Six Student Groups*

| | Student groups | | | | | |
|---|---|---|---|---|---|---|
| | Social ($n$ = 126) | Medical ($n$ = 38) | Humanities ($n$ = 84) | Natural/Math ($n$ = 75) | Engineering ($n$ = 101) | Teacher ($n$ = 60) |
| *M* | $6.44_a$ [6.13, 6.75] | $6.16_b$ [5.59, 6.74] | $5.68_c$ [5.16, 6.24] | $5.20_d$ [4.66, 5.72] | $5.09_e$ [4.70, 5.49] | $7.38_f$ [6.90, 7.83] |
| *SD* | 1.94 | 1.81 | 2.34 | 2.46 | 2.06 | 1.81 |

*Note.* Means with subscripts different than f are significantly different from the mean of the Teacher Education at $p$ <.05 based on the Games–Howell *post hoc* paired comparisons. Bootstrap 95% Confidence Intervals reported in brackets.

**Hypothesis 3: For students in the six fields of study, there will be a significant positive relationship between Academic Satisfaction and Social Satisfaction, and vocational interests represented by the JVIS vocational interest scale which is closest related to that field.**

Specifically, I expect to find a positive relationship between Social Science and both Academic Satisfaction and Social Satisfaction for students in social sciences. There will be a positive correlation between Medical Science and both student satisfaction scales for the group of medical students. In the sample of humanists, there will be a positive relationship between student satisfaction and vocational interests represented by three JVIS scales: Creative Arts, Writing and Performing Arts. Mathematical Reasoning will correlate positively with Academic and Social Satisfaction for both the natural science and math students, and the engineering students. Natural Science will be positively related to student satisfaction in the sample of students majoring in natural sciences and technology. There will be a positive relationship between Teaching and the satisfaction scales for the student teachers. Since half of the teacher students ($n$ = 31) specialize in natural sciences, I also expect a positive relationship between Natural Science and the student satisfaction measures in the sample of student teachers. Finally, there will be a positive relationship between satisfaction scores and scores on Social Science and Social Service in the homogenous sample of psychology students.

**The JVIS scores and student satisfaction for Social Science**

The results in Table 10 show that there was a significant negative correlation between Social Satisfaction and vocational interests represented by the Social Science scale in the sample of social science students. The correlation was assessed by Pearson's *r*. High vocational interest scores on Social Science were correlated with low vocational interest scores on Social Satisfaction in that group. The relationship between Social Science and Academic Satisfaction was positive, but not statistically significant, $p > .05$.

**The JVIS scores and student satisfaction for Medical Science**

A Pearson product-moment correlation coefficient was computed to assess the relationship between Medical Service and Academic Satisfaction and Social Satisfaction in the sample of medical students. As reported in Table 11, there was a significant positive correlation between vocational interests and Academic Satisfaction. The strong interest in Medical Service among the medical students corresponded with the high level of academic satisfaction. However, the bootstrapped confidence intervals included *zero*, which suggested that the results were not statistically significant. The relationship between Medical Service and Social Satisfaction was negative, but not statistically significant, $p > .05$.

**The JVIS scores and student satisfaction for The Humanities**

As presented in Table 12, positive (for Creative Arts and Writing) and negative (for Performing Arts) Pearson's correlations with Academic Satisfaction were not statistically significant, $p > .05$. Likewise, a negative Pearson's correlation between Creative Arts and Social Satisfaction, as well as positive Pearson's correlations between both Writing and Performing Arts, and Social Satisfaction were not significant, $p > .05$. All in all, vocational interests reflected by Creative Arts, Writing and Performing Arts were not correlated with the level of student satisfaction in the sample of students majoring in the humanities.

Table 10

*Summary of Intercorralations, Means, and Standard Deviations for Scores on the Social Science Scale, Academic Satisfaction Scale, and Social Satisfaction Scale for the Social Science Students*

| Measure | 1 | 2 | 3 |
|---|---|---|---|
| 1. Academic Satisfaction | – | | |
| 2. Social Satisfaction | .38** [.20, .52] | – | |
| 3. Social Science | .12 [–.07, .29] | –.19* [–.34, –.04] | – |
| *M* | 23.32 | 22.85 | 6.51 |
| *SD* | 4.57 | 4.67 | 2.43 |

*Note.* $n = 126$; *$p < .05$, two-tailed; ** $p < .01$, two-tailed; Bootstrap 95% Confidence Intervals reported in brackets.

Table 11

*Summary of Intercorralations, Means, and Standard Deviations for Scores on the Medical Service Scale, Academic Satisfaction Scale, and Social Satisfaction Scale for Medical Science Students*

| Measure | 1 | 2 | 3 |
|---|---|---|---|
| 1. Academic Satisfaction | – | | |
| 2. Social Satisfaction | –.19 [–.41, .08] | – | |
| 3. Medical Service | .55** [–.01, .78] | –.11 [–.42, .21] | – |
| *M* | 25.00 | 24.37 | 14.05 |
| *SD* | 3.80 | 3.44 | 3.43 |

*Note.* $n = 38$; two-tailed; ** $p < .01$, two-tailed; Bootstrap 95% Confidence Intervals reported in brackets.

Table 12

*Summary of Intercorralations, Means, and Standard Deviations for Scores on the Creative Arts, Performing Arts, Writing Scale, Academic Satisfaction Scale, and Social Satisfaction Scale for the Students in the Humanities*

| Measure | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Academic Satisfaction | – | | | | |
| 2. Social Satisfaction | .38** [.14, .56] | – | | | |
| 3. Creative Arts | .01 [–.21, .25] | –.10 [–.29, .10] | – | | |
| 4. Writing | .07 [–.13, .29] | .07 [–.18, .29] | –.02 [–.22, .17] | – | |
| 5. Performing Arts | –.11 [–.30, .08] | .16 [–.04, .36] | .32** [.12, .50 ] | .08 [–.13, .287] | – |
| *M* | 23.31 | 22.08 | 7.42 | 10.55 | 7.17 |
| *SD* | 4.73 | 4.88 | 3.93 | 3.51 | 3.50 |

*Note.* $n = 82$; ** $p < .01$, two-tailed; Bootstrap 95% Confidence Intervals reported in brackets.

**The JVIS scores and student satisfaction for Natural Science and Mathematics**

There were significant positive Pearson's correlations between Academic Satisfaction and both Natural Science and Mathematical Reasoning in the sample of natural science and math students (see Table 13). The results indicated that the strong preference for job-related activities represented by both scales correlated with the high level of academic satisfaction. The results for Social Satisfaction showed a significant negative relationship with Mathematical Reasoning. The negative relationship indicated that the strong preference for activities requiring mathematical and logical methods correlated with the low level of academic satisfaction. Natural Science and Social Satisfaction were not significantly correlated, $p > .05$.

**The JVIS scores and student satisfaction for Engineering and Technology**

As depicted in Table 14, Mathematical Reasoning scores did not correlate significantly with any of the student satisfaction scales in the sample of engineering and technology students, $p > .05$. The results indicated that vocational interests of the engineering students that referred to activities requiring logical reasoning were not related to the level of

academic satisfaction or social satisfaction. The correlations were measured by a Pearson product-moment correlation coefficient.

Table 13

*Summary of Intercorralations, Means, and Standard Deviations for Scores on the Natural Science Scale, Mathematical Reasoning Scale, and Social Satisfaction Scale for the Students in Natural Science and Mathematics*

| Measure | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Academic Satisfaction | – | | | |
| 2. Social Satisfaction | .05 [–.20, .28] | – | | |
| 3. Natural Science | .53** [.32, .67] | .00 [–.22, .24] | – | |
| 4. Mathematical Reasoning | .30* [.06, .48] | –.23* [–.40, –.03] | .31** [.10, .51] | – |
| *M* | 23.74 | 22.85 | 18.97 | 15.51 |
| *SD* | 3.55 | 5.34 | 5.34 | 6.09 |

*Note.* $n = 74$; *$p < .05$, two-tailed; ** $p < .01$, two-tailed; Bootstrap 95% Confidence Intervals reported in brackets.

Table 14

*Summary of Intercorralations, Means, and Standard Deviations for Scores on the Natural Science Scale, Mathematical Reasoning Scale, and Social Satisfaction Scale for the Students in Engineering and Technology*

| Measure | 1 | 2 | 3 |
|---|---|---|---|
| 1. Academic Satisfaction | – | | |
| 2. Social Satisfaction | .40** [.19, .56] | – | |
| 3. Mathematical Reasoning | .17 [–.09, .40] | –.03 [–.25, .20] | – |
| *M* | 22.56 | 24.37 | 16.96 |
| *SD* | 4.22 | 5.07 | 4.77 |

*Note.* $n = 101$; ** $p < .01$, two-tailed; Bootstrap 95% Confidence Intervals reported in brackets.

**The JVIS scores and student satisfaction for Teacher Education**

As depicted in Table 15, there were significant positive relationships between Natural Science and both satisfaction scales in the sample of student teachers. Accordingly, there were also positive relationships between Teaching and the the student satisfaction scales, but those results were not statistically significant, $p > .05$. The correlations were assessed by Pearson's *r*.

In sum, the results indicated that the strong interest in natural sciences among the student teachers and the high level of academic satisfaction and social satisfaction were correlated. However, an interest in teaching did not relate to the level of student satisfaction in the same sample.

Table 15

*Summary of Intercorralations, Means, and Standard Deviations for Scores on the Teaching Scale, Academic Satisfaction Scale, and Social Satisfaction Scale for the Student Teachers*

| Measure | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Academic Satisfaction | – | | | |
| 2. Social Satisfaction | .38** [.12, .61] | – | | |
| 3. Teaching | .22 [–.06, .49] | .01 [–.22, .22] | – | |
| 4. Natural Science | .33** [.09, .54] | .27* [.01, .48] | –.20 [–.44, .07] | – |
| *M* | 23.02 | 24.12 | 7.38 | 13.12 |
| *SD* | 3.72 | 4.35 | 1.81 | 6.81 |

*Note.* $n = 60$; *$p < .05$, two-tailed; ** $p < .01$, two-tailed; Bootstrap 95% Confidence Intervals reported in brackets.

**The JVIS scores and student satisfaction for Psychology students**

A Pearson product-moment correlation coefficient was computed to assess the relationship between Social Science and the student satisfaction scales, and between Social Service and the satisfaction scales in the sample of psychology students. Social Science and Social Service correlated significantly and positively with Academic Satisfaction. The relationship between Social Science and Social Satisfaction was negative, but not statistically

significant, $p > .05$. Social service correlated positively with Social Satisfaction, but the results were not significant, $p > .05$.

The results showed that the strong preference among psychology students for activities involving working with social science and in social service correlated with the higher level of academic satisfaction. However, vocational interest represented by both vocational interest scales and the level of social satisfaction were not interrelated in the sample of psychology students. The results are reported in Table 16.

Table 16

*Summary of Intercorralations, Means, and Standard Deviations for Scores on the Social Science Scale, Academic Satisfaction Scale, and Social Satisfaction Scale for the Psychology Students*

| Measure | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Academic Satisfaction | – | | | |
| 2. Social Satisfaction | .43** [.19, .62] | – | | |
| 3. Social Science | .28* [.04, .49] | –.10 [–.34, .12] | – | |
| 4. Social Service | .33* [.03, .58] | .19 [–.15, .50] | .12 [–.13, .35] | – |
| *M* | 23.37 | 22.22 | 6.46 | 8.39 |
| *SD* | 3.81 | 4,83 | 2.34 | 2.24 |

*Note.* $n = 59$; *$p < .05$, two-tailed; ** $p < .01$, two-tailed; Bootstrap 95% Confidence Intervals reported in brackets.

**Hypothesis 4: There will be sex differences in vocational interests indicating that men will prefer to work with things and women to work with people. Moreover, men will show a stronger preference for activities in the field of engineering, science and mathematics, while women will be more interested in artistic activities.**

Taking into account the obtained JVIS scales, men will show a stronger interest in activities that involve working with concrete things represented by the Practical scale. On the other side, a score for women will indicate a greater preference for Conventional activities. Moreover, women will be more interested in activities that are about meeting, nursing, helping and teaching others, represented by Social Service, Medical Service and Teaching.

Men will also show a stronger affinity for Mathematical Reasoning and Natural Science, and women for Creative Arts, Performing Arts, and Writing. As mentioned in the Method section, all differences were tested using independent t-tests.

The number of women and men in each of the six student samples is presented in Table C4 in Appendix C.

**Sex differences in Creative Arts**

The average mean score for Creative Arts indicated that women ($M$ = 7.00, $SE$ = 3.92) were more interested in creative and artistic activities than men ($M$ = 5.82, $SE$ = 4.01). The mean difference, 1.18, with bootstrap 95 % Confidence Intervals (designated as BCa 95% CI) [.38, 1.92] was statistically significant $t(481) = 3.01$, $p = .007$. The effect size was small, $d$ = .29, if one conforms to Cohen's rule of thumb (Cohen, 1992).

**Sex differences in Performing Arts**

On average, men ($M$ = 5.24, $SE$ = 3.32) were slightly less interested in Performing Arts than women ($M$ = 5.31, $SE$ = 3.55). However, the minimal mean difference of .07, BCa 95% CI [–.60, .71] was not statistically significant $t(481) = .18$, $p = .839$. The difference represented a very small-sized effect, $d$ = .02. The results indicated that men and women found activities involving performing for an audience equally interesting.

**Sex differences in Writing**

The third t-test revealed that the mean difference in scores on the Writing scale for men and women, .96, BCa 95% CI [.21, 1.73] was significant $t(481) = 2.37$, $p = .014$. It indicated that men ($M$ = 6.66, $SE$ = 4.04) preferred activities involving fictional and technical writing to a lesser degree than women ($M$ = 7.62, $SE$ = 4.10), with a small effect size, $d$ = .24.

**Sex differences in Mathematical Reasoning**

There was statistically significant mean difference, –4.48, BCa 95% CI [–5.72, –3.20] in preference for working with mathematical formulas and quantitative concepts between men and women, $t(481) = –7.12$, $p = .001$, which indicated that men ($M$ = 15.10, $SE$ = 6.30) were more interested in activities represented by Mathematical Reasoing than women ($M$ = 10.62, $SE$ = 6.39). Cohen's $d$ was medium, $d$ = –.71.

**Sex differences in Natural Science**

Results of the independent t-test for Natural Science were similar to those of Mathematical Reasoning. In general, a preference for activities involving working with Life Science and Physical Science among men ($M$ = 14.82, $SE$ = 6.22) was stronger than among women ($M$ = 12.17, $SE$ = 6.59). Mean difference, –2.65, BCa 95% CI [–3.87, –1.52] was significant $t(481) = –4.13$, $p = .001$. The mean difference indicated a small-sized effect, $d = –.43$.

**Sex differences in Social Service**

Significant results of the t-test, $t(481) = 6.56$, $p = .001$ suggested that men ($M$ = 4.61, $SE$ = 2.95) were less likely to choose Social Service as their interest area than women ($M$ = 6.57, $SE$ = 3.06). It indicated that women were more interested in helping people cope with their problems than men. The mean difference was 1.96, BCa 95% CI [1.41, 2.54]. The effect size was medium, $d = .66$.

**Sex differences in Medical Service**

The mean scores on Medical Service for men than women were similar ($M$ = 8.21, $SE$ = 4.50, and $M$ = 8.19, $SE$ = 4.68, respectively), which suggested that men and women were equally interested in working towards promoting health and curing disease. The results of the t-test confirmed that the slight mean difference of –.02, BCa 95% CI [–.91, .90], was not statistically significant, $t(481) = –.04$, $p = .958$. The effect size was minimal, $d = –.004$

**Sex differences in Teaching**

The average mean score for Teaching indicated that women ($M$ = 6.22, $SE$ = 2.11) preferred activities involving teaching more often than men ($M$ = 5.27, $SE$ = 2.35). The mean difference, .95, BCa 95% CI [.53, 1.43] was statistically significant $t(481) = 4.43$, $p = .001$, and represented a small-sized effect, $d = .40$.

**Sex differences in Practical–Conventional**

There was a non-significant mean sex difference, .19, BCa 95% CI [–.54, .86] in preference for practical activities (e.g. agriculture, skilled trades) and conventional activities (e.g. office work), $t(481) = .53$, $p = .616$. Men and women seemed to be equally interested in both kinds of activities ($M$ = 6.52, $SE$ = 3.64 for men, and $M$ = 6.71, $SE$ = 3.36 for women). The effect size was small, $d = –.05$.

## Discussion

Before I go on to discuss the results, present weaknesses and strengths of the study, and explore possible implications for future research and career counselling, it might be important to summarize the comprehensive results of the presented analyses.

### Summary of the results of the principal component analyses

Several subsequent oblique PCAs revealed that most of the variance (62 %) in the retained 221 variables could be explained by 17 bipolar components. The other 68 variables were omitted in the stepwise analyses in order to improve the reliability of the components or the component structure. Nineteen definite and meaningful scales could be distinguished. With two exceptions, those scales were tantamount to either A-components or B-components, dependent on which of the items or poles (A or B) provided with the most unambiguous and meaningful interpretation.

### Summary of the results of the one-way ANOVA tests

There were significant differences in vocational interests across the six student groups for all the scales selected for the analyses: Social Science, Medical Service, Creative Arts, Performing Arts, Writing, Mathematical Reasoning, Natural Science, and Teaching.

The *post hoc* paired comparisons (i.e. the Bonferroni, Hochberg's GT2, and Games–Howell procedures) revealed that some student groups had the significantly strongest interests in the expected fields, represented by the highest mean score on the respective JVIS scale. Specifically, the medical students, the humanists, and the natural scientists had the highest mean scores on Medical Service, Writing and Natural Science, respectively. The group in natural sciences and mathematics, and in engineering and technology, had the highest, not significantly different, mean scores on Mathematical Reasoning. However, only the mean score for the engineers was significantly different from that of the other four groups (i.e. Social Science, Medical Science, the Humanities, and Teacher Education). The mean score for the natural scientists and mathematicians was significantly higher only when compared to that of the social science students and the students in the humanities. The mean score on Teaching was also highest for the student teachers. However, the mean differences between the student teachers and each of the other five groups were significant only for the Games–Howell comparisons. When the other two *post hoc* tests were used, the significant

differences in the preference for teaching existed only for the comparisons with three groups: the Humanities, Natural Science and Mathematics, and Engineering and Technology.

The results of the other *post hoc* comparisons showed that some student groups had the strongest preference for the activities closest related to their field of study, but not for all comparisons. The highest mean score on Social Science for the social science students was significantly different from that of both the medical students and the engineering technology students, but not the other three groups. When it comes to Performing Arts, the only group that did not differ significantly in their mean scores from the humanists was Medical Science. The remaining four groups scored significantly lower on that scale than the humanists.

The mean score on Creative Arts was highest for the students in natural sciences and mathematics, whereas the humanists had the second highest score. While the *post hoc* comparisons for the former group were significant in three cases (i.e. for the comparison with Social Science, Medicine, and Engineering and Technology), there were no significant differences in vocational interests for any of the five comparisons with the humanities group.

**Summary of the results of the correlation analyses**

There were significant positive relationships between vocational interests and Academic Satisfaction for four student groups: Medical Science, Natural Science and Mathematics, Teacher Education, and Psychology. Specifically, there was a significant positive relationship between Academic Satisfaction and Medical Service for the medical students, between Academic Satisfaction and both Natural Science and Mathematical Reasoning for the natural scientists and mathematicians, between Academic Satisfaction and Natural Science for the student teachers, and between Academic Satisfaction and both Social Science and Social Service in the sample of psychology students. The bootstrap Confidence Intervals for the correlation coefficient in the medical student sample crossed zero, which caused doubts about the statistically significant result.

The remaining correlations with Academic Satisfaction were not statistically significant. The non-significant results applied to the relationship with the following scales: Social Science in the sample of social science students, Creative Arts, Performing Arts, and Writing in the sample of humanists, Mathematical Reasoning in the sample of engineering students, and Teaching in the sample of student teachers.

When it comes to Social Satisfaction, the only significant positive relationship with vocational interests was found for Natural Science in the sample of student teachers. Moreover, two significant negative correlations were produced:  for the relationship with

Social Science in the sample of social science students, and for the relationship with Mathematical Reasoning in the sample of natural science and math students.

Social Satisfaction did not correlate significantly with the other vocational interest scales: Medical Service in the sample of medical students, Creative Arts, Performing Arts, and Writing in the sample of humanists, Natural Science in the sample of natural science and math students, Mathematical Reasoning in the sample of engineering and technology students, Teaching in the sample of student teachers, and Social Science, and Social Service in the sample of psychology students.

**Summary of the results of the independent t-tests**

There were significant sex differences in the mean scores on six Norwegian JVIS vocational interest scales selected for the analyses: Creative Arts, Writing, Social Service, Teaching, Mathematical Reasoning, and Natural Science. On average, there was a stronger preference among women for activities that constituted the first four scales and among men for activities represented by the last two scales. No significant sex differences in vocational interests represented by the scales Performing Arts, Medical Service, and Practical Activities–Conventional Activities were found. The effect sizes varied from small to medium. The two biggest effects were found for Mathematical Reasoning and Social Service.

**Content validity of the Norwegian JVIS scales**

In line with Hypothesis 1, I expected that the Norwegian version of the JVIS would have a similar structure to that of the original inventory. There is ″a halfway″ support for this hypothesis. Nineteen out of the total 34 American scales which were, to a greater or lesser degree, similar to the American basic scales emerged after the final PCA.

As described before, the interpretation of those 19 scales was based in most cases on the most unambiguous, meaningful, and uniform pole that constituted each component (see Table 1). The labels of the scales reflect that interpretation. Accountability–Independence and Practical Activities–Conventional Activities are exceptions in that respect, since both the pole A and the pole B clearly and comprehensibly represented underlying vocational interests. The descriptions of the other scales that appeared after the final PCA were based on the rough interpretation of the item clusters that formed those scales. They reflect, to a lesser or greater degree, the general occupational themes of the JVIS or the RIACES types. Interestingly, the majority of those ″second pole″ interpretations point toward the Enterprising theme and the Enterprising type (e.g. for components 2, 5 and 11). The other represented general

occupational themes are Expressive, Practical, Logical, Socialized, Assertive, and Inquiring for the A-poles, and Helping, Conventional, Communicative for the B-poles.

It is important to stress that the interpretation the components was subjective, which is frequently the case in the last, interpretative phase of PCA. Since my intention was to identify unambiguous and easily interpretable scales that gave comprehensible scores, I found it most purposeful to focus on the unipolar rather than bipolar interpretations.

Following Jackson's classification of the JVIS scales (Jackson, 2000), there are thirteen scales that are equivalents to the original *work role* scales (i.e. Mathematical Reasoning, Performing Arts, Writing, Medical Service, Adventure, Natural Science, Professional Advising, Teaching, Social Science, Social Service, Creative Arts, Practical Activities, and Conventional Activities), and six scales that are equivalents to the original *work style* scales (i.e. Interpersonal Confidence, Accountability, Independence, Stamina, Dominant Leadership, Job Security).

Many of the work role scales resemble the original JVIS scales to a great degree. One of them – Medical Service – is actually identical to its American counterpart. It consists of 17 items that describe activities in the area of medical and health care. Some of the scales, for example, Adventure, Social Science, Performing Arts, Social Service, or Job Security include the same items as their American equivalents, but their number is lower than that of the original scales (i.e. < 17). Furthermore, some Norwegian scales, for instance Mathematical Reasoning, Natural Science, Writing, Creative Arts, Conventional Activities and Practical Activities, consist of items that belong to different scales in the original version of the test. However, that very fact does not stay in the way of interpreting them meaningfully. For example, most of the items belonging to Mathematical Reasoning are a part of the scale called Mathematics in the original JVIS. The additional items, which refer to activities relevant for working with engineering design, or planning and conducting research (i.e. activities from the scales Engineering and Physical Science), fits easily in the context of Mathematical Reasoning, that is, the preference for activities requiring adopting mathematical formulas and logical methods to problem solving. Natural Science also encompasses activities that can be put under the umbrella of similar vocational interests, that is, exploring the world of living and non-living nature, most often in a laboratory setting.

All in all, the identified work role scales have good face validity. Since they also correspond to their American counterparts, they represent a high degree of the construct being measured (i.e. have high content validity) (Field, 2013). Also the fact that they could be assigned to one of the general occupational themes or one of the Holland's vocational

personality types speaks in favour of their content validity. Adventure seems to be an exception in that respect. It looks like it actually does not match any of the six Holland's types or any of the ten Jackson's themes. It is actually not mentioned in Jackson's general occupational themes classification (Jackson, 2000; see also Table B2 in Appendix B). At the same time, this particular scale encompasses similar vocational interests, described as an affinity for job activities requiring risk-taking or dealing with novel situations. It is also very similar to the Adventure scale of the original JVIS. Consequently, it appears to have good face and content validity.

The interrcorrelations of work role scales in the whole sample (see Table C2 in Appendix C) also indicate good validity of the work role scales. The relationships between the scales, that would be expected to correlate positively or negatively with each other (e.g. on the basis on their affiliation to general occupational theme), are significant. For instance, Medical Service correlates significantly with Natural Science, $r = .41$, and Social Science, $r = .13$, and Social Science significantly with Natural Science, $r = .32$. Medical Service, Social Science and Life Science (which is replaced here by Natural Science) originally belong to the Inquiring theme. There is a significant positive relationship between Creative Arts and Performing Arts, $r = .36$, which would be expected, based on the common Expressive theme. Social Service and Teaching, the scales that constitute the Helping factor in the American JVIS, also correlate positively with each other, $r = .45$. Moreover, Teaching correlates negatively with Practical Activities, $r = -.12$, which could be expected, based on the fact that the scales represent two opposite poles of Prediger's people versus things dimension (see Prediger, 1982, 1996; Prediger and Vansickle, 1992).

The work style scales are to a certain degree similar to their American counterparts. They can be treated as good measures of, for example, Job Security or Stamina. Still, it is unclear if they actually assess preferences for working in specific environments, or personal qualities of the respondents. Jackson (2000) himself pointed out that the immediate tendency was to regard those scales as measures of personality characteristics, even though they were supposed to reflect interests in work environments requiring specific modes of behaviour.

Some of the items belonging to the work style scales refer to activities that describe a preference for working in a specific environment. The examples include: ″preferring to work for a stable organization rather than for an organization with an unstable future″ (Job Security), or ″preferring to work under pressure″ (Stamina). Dominant Leadership resembles in many ways a work role scale, since it measures a vocational preference for having a position of authority in an organization. However, some of the other work style items

represent personal qualities rather than vocational interests, for example ″being considered trustworthy″ (Accountability), and ″pressing myself to work harder″ (Stamina). Even though these sentences are meant to represent vocational preferences, is it possible to measure vocational interests by asking if a person prefers to have specific personal qualities? This is an important question to ask, because a negative answer may indicate that the validity of the work style scales as *vocational interest* scales is seriously jeopardized. We know from the Theory section that vocational interests and personality are different psychological constructs which jointly influence motivation (Barrick et al., 2003; Mount et al., 2005). Vocational interests are not another aspect of personality (Crites, 1999).

The inspection of the intercorrelations with the work style scales (see Table C2) also reveals some inconsistencies. For instance, Accountability correlates significantly with Stamina, $r = .13$, and Job Security, $r = .12$, and Stamina with Job Security, $r = .16$, which could be anticipated on the basis of their affiliation to the same theme (i.e. Socialized). There are positive, but not statistically significant, relationships between Dominant Leadership and both Interpersonal Confidence and Independence ($r = .01$ and $r = .08$, respectively) – the scales that represent the Assertive theme. Interpersonal Confidence and Medical Service correlate negatively, $r = –.08$, even though people who choose medical occupations would be expected to show a preference for work environments requiring frequent interaction with others. Adventure and Job Security, which apparently designate two contrasting vocational interests, that is, a preference for activities involving taking risk, and a preference for stable and safe work environments, correlate negatively, $r = –.08$, but not significantly. Many of the correlations with the work style scales are also low and not statistically significant.

**Superfluous variables**

The purpose of PCA is to identify the underlying linear patterns in a set of variables, that is, to check if the variables refer to the same ″hidden″ trait or phenomenon (Field, 2013; Field et al., 2012). As mentioned above, there were 68 bipolar variables whose omission in the further analyses was treated as necessary in order to improve the structure of the inventory or the reliability of the scales. The most common reason for excluding variables was their weak correlations with the other items, and low factor loadings on the components (i.e. <.35). They simply did not refer significantly enough to any of the interest scales obtained in the analyses. The problem of two or more variables loading highly on more than one component was almost negligible, which indicates that the obtained components, and

therefore also scales, have the pure structure. That is, at least as long as it is possible to regard components consisting of two different poles as having homogeneous structure.

The number of 17 components seemed to be the most reasonable solution that could be applied to the available data, even though it meant omitting several variables. I could have decided to retain more than 17 components, and consequently also more variables. For example, Kaiser's criterion indicated that 68 components should have been retained. However, the 26-component solution, based on the results of the parallel analysis, revealed that some components would consist of very few variables. It indicated that if more components were retained, very small, equivocal components, consisting of one to three variables, must have been accepted as meaningful entities. Since the objective of the study was to reduce 289 variables to meaningful clusters which would resemble the original JVIS scales, it did not seem purposeful to retain small components just for the sake of retaining them, or for the sake of omitting fewer variables in the analyses. Jackson (2000) also stressed that the number of 34 was just one of the ways of categorizing the scales. Alternative categorization of scales was possible and more useful for other purposes.

On closer inspection, most of the variables that did not load highly on any of the obtained components, referred to work styles (e.g. ″working hard on a job task″ and ″being considered trustworthy″), family activities (e.g. ″reading a bed story for a child″), office work activities (e.g. ″addressing post″), personal service activities (e.g. ″working as a hairdresser″), or skilled trades activities (e.g. ″making plastic false teeth″). The fact that many work style variables did not correlate highly enough with any of the other variables, could be explained, by their ambivalent nature. Specifically, as indicated in the previous subsection, they may reflect other psychological constructs than vocational interests. Those items might then become more prominent if one was to explore the structure of other phenomena (e.g. personality). It seems, however, conspicuous that many items referring to activities that do not require academic skills or higher education were omitted. This is especially noteworthy taking into account the fact that many of the retained Norwegian scales refer to vocational interests that young people or students majoring in the specific study programmes could be expected to be salient on (e.g. Adventure, Mathematical Reasoning, Natural Science, and Social Science). This may indicate that the interest pattern obtained in the current study may represent the general preference pattern of the student population, or just the preference pattern of the sample in question, but not that of the whole Norwegian population.

**Reliability of the scales**

The scales of the Norwegian version of the JVIS are characterized by a high internal reliability measured by ordinal alpha. As described in the Method section, ordinal alpha is recommended for estimating reliability of binary and ordinal response scales (Gadermann, et al., 2012; Zumbo et al., 2007). As presented in Table 1, the value of ordinal coefficient alphas, $\alpha_{alpha}$, in the current study varies .71 for Interpersonal Confidence to .96 for Mathematical Reasoning, with a median of $\alpha_{alpha} = .89$. The corresponding Cronbach's alpha for the same scales were .92 and .52, respectively, which is indicative of Cronbach's alpha deflating the reliability estimates. Interestingly, the reliability test of the American scales among 1,750 men and 1,750 women revealed the highest Cronbach's alpha for Mathematics ($\alpha = .88$), and the lowest for Professional advising ($\alpha = .54$) (Jackson, 2000). In the current study, the former scale (named Mathematical Reasoning) had the highest ordinal alpha (see above), and the latter the third lowest coefficient, $\alpha_{alpha} = .75$.

A value of .70 to .80 is typically an acceptable value for alpha when used to estimate scale reliability in a research setting (Field, 2013; Field et al., 2012; Nunnally, 1978). However, for applied settings, the accepted value of alpha is at least .80, and for high-stake psychological tests even greater than .90 (Nunnally, 1978). Since this is a preliminary and exploratory research on the nature of the translated JVIS, the value of alpha higher than .70 for all the scales, seems satisfactory.

**Group affiliation and the JVIS scores**

The results of the one-way ANOVAs strengthen the validity of the eight Norwegian scales: Social Science, Medical Service, Writing, Performing Arts, Mathematical Reasoning, Natural Science, and Teaching. The only exception is Creative Arts because the results for that particular scale do not support Hypothesis 2. The humanists were not the group most interested in creative and artistic activities. Despite having the second highest score, they were as much interested in Creative Arts as any of the other student groups. The group that had the highest score on Creative Arts was natural science and math students.

A possible explanation for the inconsistent results for Creative Arts is a low number of art students participating in the study ($n = 5$). Consequently, vocational interests in fine and applied arts were not ″truly″ represented. Taking into account that Creative Arts consists of 16 items (i.e. the total mean score of 8), the average scores for all the six student groups are actually not very high (see Table 4), which may suggest that the students were generally either averagely interested or not much interested in these kind of activities.

It is also important to bear in mind that all the JVIS vocational interests and the mean scores are bipolar. This bipolarity may explain why the highest score on Creative Arts for the group of natural science and math student was significantly different from the social science, the medicine, and the engineering students. It in fact indicated that the natural scientists and mathematicians, while faced with two different options, preferred art activities more than activities in sales, business, and human relations management, represented by the opposite Enterprising pole. Similar ″bipolar ″ interpretations refer to any of the other JVIS scores included in the one-way ANOVAs.

The other results support Hypothesis 2 to a large extent. The medical students may be the most interested in promoting health, treating and curing people, and immersing themselves in medicine-related questions. The humanists are likely to show the strongest preference for literary activities, such as producing fictional or factual texts. Moreover, they also seem to be more interested in entertaining an audience, either on the stage or on the screen, than the other student groups. The only exception is the group of medical students who seem to have the same interest in Performing Arts as the humanists. As hypothesized, the group studying natural sciences and mathematics seem to enjoy activities related to exploring the nature of non-living matter, and the world of the living organisms, more than any of the other student groups. There is also a substantial support for the hypothesis that a preference for applying quantitative methods to problem solving is strongest among students majoring in engineering and technology, as well as in natural sciences and mathematics. While the former group seem to prefer this kind of activities more than any of the four remaining student groups (i.e. Social Science, Medical Science, the Humanities, and Teacher Education), the preference among students belonging to the latter group appears to be stronger, compared to the social science students and the humanists. The medical students and the student teachers seem to be equally salient on vocational interests represented by Mathematical Reasoning, as the natural scientists and mathematicians. Vocational interests represented by the Teaching scale are likely to be strongest among the student teachers across the six student groups, which again substantiates the second hypothesis. However, the inconsistent results of the post hoc tests suggested that the preference for teaching, especially at the elementary level, may be equally strong for the students in teacher education, medical science, and social science.

The results clearly indicate that it is possible to use scores on the particular vocational interest scale to differentiate between preferences of various student groups. Thus there is

preliminary evidence for the possibility of using the JVIS scores to predict the group affiliation for a particular respondent.

All in all, the *post hoc* results give full support for Hypothesis 2 for some JVIS vocational interest scales (i.e. Medical Service, Natural Science, Writing), partial support for some others (i.e. for Social Science, Performing Arts, Mathematical Reasoning, and Teaching), and fail to back up the hypothesis for Creative Arts. Subsequently, there is strong evidence for the JVIS vocational interests being most salient for the expected student groups. The results also indicate that the majority of the selected scales may have high concurrent validity (i.e. they can be used for comparisons with different criteria; see Field, 2013).

**Vocational interests and student satisfaction**

The American version of the JVIS offers an Academic Satisfaction score. If an individual's profile is similar to that of an average university student engaged in a traditional academic field of study, the Academic Satisfaction score will indicate that he or she may find scholarly activities interesting (e.g. serious reading, doing research, working on academic assignments) (Jackson, 2000). In Jackson's terms, the Academic Satisfaction score is a measure of general satisfaction with academic life without taking into consideration specific vocational or academic interests within each of the academic clusters. If a work style scale *Academic Achievement* appeared in the translated JVIS, it would be possible to use scores on that scale as a possible predictor of general academic satisfaction, in a similar way Jackson (2000) described it. Academic Achievement represents preference for scholarly tasks and academic environments (see Table B1 in Appendix B for a more detailed description).

However, hypothesis 3 focused on student satisfaction at the micro-level, in other words, on the relationship between student satisfaction and vocational interests in a specific study environment designated by the six main fields. Testing the third hypothesis was tantamount to testing the congruence theory (e.g. Pervin, 1967; Furnham, 2001). The analyses concentrated on the fit between vocational interests (P) and the field of study (E) (i.e. the P–E fit; see e.g. Pervin, 1967; Furnham, 2001), and its relationship with the outcome variables – Academic Satisfaction and Social Satisfaction.

Even though a respondent's interest profile resembles that of a specific student group (e.g. the medical students), it does not immediately suggest that he or she would be satisfied with the academic or social environment in a particular field of study (e.g. medical science). There must be a certain degree of relationship between the JVIS scores, and scores on the

student satisfaction scales for each student group. In the light of the results of the correlation analyses, there is weak evidence for the relationship between vocational interests and academic satisfaction in different student samples, but especially between vocational interests and social satisfaction. It concurrently also means that there is little support for Hypothesis 3, and that the JVIS scores do not serve as the best comparison variables for student satisfaction criteria, which consequently may affect their concurrent validity.

The results partially indicate that being interested in activities within a specific field of study, and at the same time majoring in that field *may* contribute to greater academic satisfaction, that is, greater satisfaction with educational atmosphere, coursework and intellectual stimulation in the courses. I have used the word ″partially″, because the significant positive relationship existed in a few cases. Specifically, being interested in activities involving mathematical reasoning or working with natural sciences, and studying natural sciences and mathematics *may* be indicative of greater academic satisfaction. Training to be a teacher and showing a strong preference for activities represented by the Natural Science scale (but not the Teaching scale) *may* also induce greater satisfaction with the academic student life. The fact that interest in activities involving working with natural science was related to academic satisfaction in the sample of student teachers, can be explained by the fact that many students in this group trained to be natural science teachers. In a corresponding manner, psychology students, whose vocational interests encompass job activities within the realm of Social Science and Social Service, *may* be more satisfied academically. The results were also in line with Hypothesis 3 for the correlation between Academic Satisfaction and Medical Service in the sample of medical students, but the 95% bootstrap Confidence Intervals indicated that the correlation coefficient could be negative or even zero (no relationship), as well. None of the other tested relationships turned out to be significant, which indicate that enjoying activities that relate to specific majors (e.g. Social Science for a social science student, Creative Arts for a humanist, or Mathematical Reasoning for an engineering student), did not relate to the level of satisfaction with the academic environment in those specific fields.

When it comes to Social Satisfaction, the results were inconclusive. The only result in favour of Hypothesis 3 was found for Natural Science in the sample of student teachers. It was also the sole indication that having specific vocational or academic interests, and putting those interests into practice by studying subjects related to them, *may* induce greater satisfaction with the social environment (i.e. classroom atmosphere, student social events, and co-students). Moreover, Social Satisfaction showed a significant negative relationship

with two JVIS scales in two student samples: Social Science in the sample of social science students and Mathematical Reasoning in the sample of natural science and math students. Those results are actually the opposite of what was expected on the basis of Hypothesis 3. They actually suggest that the congruence between an individual's preferences for activities involving working with social sciences, and the environment that promote these interests, *may* be related to lower satisfaction with the social side of that environment. Similarly, enjoying working with mathematical and logical solutions to various problems, and being able to cherish and evolve that interest by studying natural sciences and mathematics, *may* indicate dissatisfaction with the social environment in this particular major. The remaining relationships were not statistically significant, which suggests that a match between preferences (e.g. represented by Writing or Teaching) and the field of study (e.g. the humanities or teacher education), was not related to the level of social satisfaction.

As it is most of the correlation analyses failed to support the third hypothesis. Still, there is weak initial evidence for the interplay between the P–F fit and some academic outcomes. It seems that vocational or educational interests may serve as moderators of academic satisfaction in some academic environments. For Natural Science in the sample of natural science students, the evidence is strong and the effect large, $r = .53$ (interpretation of the effect sizes based on Cohen, 1992). It is even higher for Medical Service in the sample of medical students ($r = .55$), but seeing that the Confidence Intervals included zero, it is difficult to regard these results as statistically significant. The remaining significant correlation coefficients for relationship between the JVIS scores and Academic Satisfaction scores vary from .28 to .33, indicating medium effects. For the Social Satisfaction scale, the significant relationships and effect sizes are small to medium, as they range from – .19 to .26.

It is important to stress that correlation coefficients do not say anything about the causality of the effect, but only indicate the strength and nature of the relationship. That is why, when I interpreted the results, I suggested that being interested in specific activities *may* or *may not* lead to greater satisfaction from academic student life, and greater or lower satisfaction with the social student environment. Nonetheless, the ″reverse″ interpretation is equally valid, that is to say, that being satisfied with the academic or social environment may make an individual more interested or even less interested in specific activities

A possible explanation for the non-significant results of the correlation analyses is that there are other variables that are more crucial for predicting academic satisfaction and social satisfaction among students. Abilities, self-efficacy, social support from co-students and university staff, personality, or the level of self-confidence may show a stronger relationship

with student satisfaction than vocational interests. This may be especially true for Social Satisfaction which to a greater degree shows weak and non-significant relationship with the JVIS scores. Social Satisfaction is also a variable which is more likely to be attributable to other psychological factors than vocational or academic interests (e.g. social support and personality). The analyses were also purely correlational which means that other variables, such as, for example, the level of study and gender, were not controlled for.

There is also a possibility that the non-significant correlations are reliant on the characteristics of the samples. If there is little dispersion of the scores in a sample due to the fact that most of respondents score high on a specific vocational interest scale or student satisfaction scale, there is a possibility of introducing a non-normality and non-linearity bias to the data (see Field, 2013). Describing the distribution of and linear models for the variables will take many pages of this thesis, but I refer the reader to Table C3 in Appendix C (i.e. specified means and standard deviations of the scores for each group). However, I will try to illustrate this possible problem with one example. The scores on Mathematical Reasoning and Academic Satisfaction for the engineering students are relatively high, which may be indicative of skew distribution. As presented in Figure C in Appendix C, there were few cases having low scores on both scales. The scatterplot shows that most of the values cluster in the upper region of the Academic Satisfaction and Mathematical Reasoning scales, which may suggest that it will be more difficult to find a significant linear relationship.

The problem in question indicates that using student samples with already well-defined interests may not be the best way to study a relationship between student satisfaction and vocational interests. If respondents already have chosen their field of study (e.g. social sciences or medicine), they in a way have declared what their interests are, and will probably also score high on the scales that refer to those interests (e.g. Social Science and Medical Service). Additionally, if a respondent already have made his or her preliminary career choice by deciding to be a student, he or she may initially find academic environment more satisfying than the general population.

The scales included in the analyses represent just one of the poles of each component. The significant positive relationship between one of the student satisfaction scales and a particular A-component, for example, Mathematical Reasoning indicates a significant negative relationship between that specific satisfaction scale and the B-component, that is, Enterprising/Helping. Conversely, a positive relationship between Academic Satisfaction or Social Satisfaction, and a specific B-component, for example Teaching, suggests a negative relationship between the student satisfaction scales and the opposite A-component which in

case of Teaching mostly refers to the Practical occupational theme. The bipolarity of the components may be a possible explanation for the significant negative relationship between Social Satisfaction and Social Science in the sample of social science students, and between Social Satisfaction and Mathematical Reasoning in the sample of natural science and math students. The negative relationship between the variables in these samples corresponds to the positive relationship between Social Satisfaction and activities where persuasive, instructional, and advisory motives predominated (Enterprising/Helping), or activities within professional advising and human relations management (Enterprising), which are, respectively, the opposite pole to Mathematical Reasoning and to Social Science. This may even suggest that examining relationship between the ipsative JVIS scores and Social Satisfaction should rather concentrate on vocational interests that refer to activities involving social interaction with others. Perhaps, a preference for environments that require a high degree of sociability, and job activities that involve dealing with others in various contexts (e.g. Enterprising) is positively linked to social satisfaction, while vocational interests that imply a more individual and solitary work (e.g. Mathematical Reasoning) are not. There is, for example, a significant positive correlation between Social Satisfaction and the ″social″ Teaching scale, $r = .14$, and a significant negative correlation between Social Satisfaction and the ″solitary″ Creative Arts scale, $r = –.13$, in the whole student sample (see Table C2 in Appendix C). However, this kind of interpretation does not explain why Natural Science was positively related to Social Satisfaction in the sample of student teachers. Nor does it make it plain why Social Satisfaction does not relate significantly to any of the other ″social″ JVIS scales in the other samples (e.g. Social Service in the sample of psychology students). All in all, the results suggest a spurious relationship between Social Satisfaction and vocational interests.

In the light of the previously described studies of the congruence theory, both significant and non-significant results in the current study do not come as a great surprise. As presented in the Theory section, some researchers demonstrated that there was a clear relationship between vocational interests and job satisfaction in an environment that promote those interests (Furnham & Schaffer, Mount & Muchinsky, 1978), whereas others provided a marginal support for the congruence theory (Furnham et al., 1995; Tinsley, 2000). Similarly, the research on the fit between educational interests and environment, and its relationship with academic satisfaction did not produce clear results. In a study of Nafziger et al. (1975), the fit between vocational interests and major field was predictive of satisfaction with that field, but not with the total college environment. Smart (1987) suggested that vocational and

academic interests might serve as moderators of student satisfaction. Other researchers did not find evidence for significant correlations between the variables (Tranberg et al., 1993). All things considered, the P–E-fit, described in the current study, may not be the best predictor of student satisfaction (see also Tinsley, 2000).

**Gender differences in vocational interests**

Research that spans over many years has revealed that men and women have dissimilar preferences for specific work activities (see e.g. Betz & Fitzgerald, 1987; Nordvik, 1991a; Schreiner 2008, 2009; Su et al., 2009). Generally, women are more interested in jobs that involve helping others, while men prefer to work with tools, machines and objects. Women are also more likely to represent the Artistic type, while men tend to be more Investigative. The distinction between femininity and masculinity with reference to vocational interest lies alongside the people–things dimension (Lippa, 2001; Sue et al., 2009).

The results of the current study confirm the existence of gender differences in vocational interests. These results reflect for the most part the previous findings and theories. They give strong support for Hypothesis 4. The may also speak in favour of the concurrent validity of some of the JVIS vocational interest scales. The comparisons of the mean JVIS scores for men and women using independent t-tests revealed that women are more likely to be interested in work activities involving social interaction, such as helping, treating or teaching others. There may also be a stronger preference among women for creative activities such as artistic and aesthetical work or writing. On the other side, men are likely to enjoy activities requiring an investigative approach, such as natural sciences and mathematics, to a larger extent than women.

The mean differences for Medical Service, Performing Arts, and Practical Activities–Conventional Activities were not statistically significant, suggesting that men and women are equally interested in work activities entailing medical and health care, requiring artistic and creative skills to entertain an audience, and referring to practical tasks (e.g. agriculture, skilled trades), or conventional responsibilities (e.g. work office, finance, business work). Consequently, the results for these four scales fail to support Hypothesis 4, indicating that gender differences in vocational interest in some areas have evened out (see also Nordvik, 1991a). They may also suggest that the activities represented by these four scales are traditionally regarded as much relevant for Norwegian men as for Norwegian women, which may in turn result in both sexes being more likely to select them as areas of their interests.

The bipolarity of the components should not be neglected while interpreting the results of the t-tests. Significant and non-significant results would apply not only to the vocational interests described by the scales used in the analyses, but also to the scales that constitute their opposite poles. The interpretation for the non-significant test for Practical Activities–Conventional Activities is a good example in that respect. Both practical and conventional activities were equally popular among men and women.

The effect sizes indicate that none of the tested differences are very large. The biggest differences was found for Mathematical Reasoning ($d$ = –.71) and Social Service ($d$ = .66), which are the areas of vocational interests that are generally found to be the most prominent for men and women, respectively (see Ceci et al., 2006; Su et al., 2009). The inspection of the other effect sizes revealed small effects (from $d$ = –.004 for Medical Service to $d$ = –.43 for Natural Science), which suggests that sex differences in vocational interests may not be substantial. Moreover, the results also suggest that the main sex differences refer to Prediger's people pole (Social Service) and ideas pole (Mathematical Reasoning), but not to the things pole (as in Lippa, 2001; Sue et al., 2009), as represented by the non-significant results for the Practical Activities scale.

The number of men and women in each student sample (see Table C4) also affects the way of interpreting the results. There are four times as many women in social sciences and approximately three times as many women in medical science than men, which may be a plausible explanation for why women were more interested in job activities that presuppose helping other people (Social Service). The same may apply to a preference for teaching, creative arts and writing. Specifically, men were underrepresented in teacher education ($n$ = 13 against $n$ = 47 for women) and the humanities ($n$ = 22 against $n$ = 62 for women). In fact, the majority of male respondents studied natural sciences and mathematics or engineering and technology ($n$ = 78), which may have shifted the whole vocational interest pattern among men towards science and mathematics (Natural Science and Mathematical Reasoning).

## Limitations

In the following subsections, I will focus on several weaknesses relating to the current study. These limitations may be important if one wishes to improve the research on the Norwegian version of the JVIS. Possible shortcomings of the JVIS will also be reviewed.

**Problem of ipsativity.** The construction of the JVIS was grounded in the extensive development process (see Jackson, 2000 for a detailed description). It is also based on the

rational, rather than empirical, approach to the scale development which is advocated by many vocational researchers (Ashton & Goldberg, 1973; Goldberg & Slovic; Jackson, 1971, 2000; Savickas, 1999; Silvia, 2006). However, the theory behind the JVIS remains obscure. It is, for example, not very clear why specific items were chosen as the A statements, and why others were assigned to the B group. The critique of the JVIS written by Juni and Koenig (1982) seems in many ways to be well founded. The qualitative approach to the items, at least in the final construction stage, seems to have been neglected at the expense of advanced statistical and computer-based methods. The development of the scales is conceptually grounded. Yet paradoxically, the structure of the JVIS is based on the empirical rather than rational incentives**.**

The forced-choice format may also cause confusion among respondents. In line with the problems reported by Juni and Koenig (1982), it is questionable why items apparently referring to different phenomena were combined with each other. Within the statement pairs, job activities are mixed with self-description statements, vocations with avocations, specific occupations with general work styles, roles with one-off events (Juni and Koenig, 1982) – the format that might have contributed to misinterpretation, random selection or omission of some items.

The bipolarity of the components may also cause confusion by suggesting that vocational interests belonging to the A- and B-poles should be regarded as each other's opposites. Treating different vocational interests as more or less inverse dimensions seems to be a remnant of Holland's theory (Holland, 1973, 1985, 1997). If we take into consideration the Holland's model, it seems that most of the alternatives A refer to Realistic, Investigative and Artistic activities, while most of the B-items describe Social, Enterprising, and Conventional interests. Thus the items representing the RIA corners of the hexagon are mostly mixed with the items belonging to the opposite SEC corners. Examining the JVIS scales with reference to Holland's typology could indicate that Jackson (2000) might have drawn inspiration from the RIASEC model while constructing the JVIS, even though he did not state that explicitly. However, Holland's RIASEC model is just a schematic representation of vocational interests. Holland himself has never claimed that specific vocational interests should be treated as contrary constructs (Holland, 1973, 1985, 1997). Showing a strong preference for activities represented by the Artistic corner of the RIASEC hexagon does not imply having no interest in activities reflected by the opposite Conventional corner. Enjoying activities that involve the Investigative approach is not synonymous with disliking those that demand Enterprising ideas and actions. Normally,

people will show different levels of vocational preferences which may indeed be high and low, respectively, on two scales defined as each other's opposites, but which may also be equally high or low for two apparently opposite vocational interest scales.

It does not mean that the main idea behind the JVIS structure is to regard different vocational preferences as opposite concepts. However, the inventory does not reflect the possible proximity of vocational interests, as, for example, represented by Gati's hierarchical model (Gati, 1981). Vocational interests complement, rather than contradict one another. They are graded rather that ″either or″ concepts. Considering vocational preferences in this way may even indicate that they are more of a Likert rather than a forced-choice character.

The ipsative nature of the JVIS makes it impossible to replicate the structure of the original test in the translated version of the inventory. If the items are arranged in such a way that items belonging to different scales are combined with each other (i.e. an item from each of the 17 basic scales in the A group is paired with an item from each of the 17 basic scales in the B group) (Jackson, 2000), one of the poles will always be more conspicuous than the other, dependent on the response pattern in a particular sample. The current structure of the JVIS will also always produce bipolar factors that will reflect the fact that choosing one item or one scale, inevitably means ignoring another (Baron, 1996). The ipsative format of the JVIS could also have contributed to the problem of singularity in the PCAs, even though this particular problem could also easily be attributed to tetrachoric correlations (see Higham, 2002; Wothke. 1993) or a relatively small sample (Anderson & Gerbing, 1984).

As discussed before, the bipolarity of the scales causes problems for the unambiguous interpretation of the components and the results of the analyses. However, it is also problematic while interpreting reliability estimates. Bearing in mind the mutual dependency of A-poles and B-poles in estimating tetrachoric correlations, it seems most reasonable to interpret the coefficients as bipolar. Ordinal alpha is based on the polychoric or tetrachoric correlation matrix (Gadermann et al., 2012; Zumbo et al., 2007). This duality seems especially valid for the interpretation of the reliability coefficients of two obtained scales: Accountability–Independence, and Practical Activities–Conventional Activities. Accordingly, $\alpha_{alpha}$ =.73 will apply to both Accountability and Independence, and $\alpha_{alpha}$ = .88 to both Practical Activities and Conventional Activities. The ipsative format of the JVIS may also give a false sense of confidence regarding high internal reliability of the scales. Ipsative measures tend to inflate originally low reliability coefficients (Tenopyr, 1988).

As suggested in the Results section, the ipsative format of the JVIS makes the scoring process questionable, as well. A low or high score on one of the poles will always

correspond with a high or low score on the respective A- or B-pole of the same component. One may criticize the scoring process in the current study for not reflecting the bipolarity of all the components, that is, for just concentrating on the meaningful poles. After all, all items belonging to each meaningful A- or B-scales were assigned a value of 1, and all items that constituted the opposite ″less meaningful″ B- or A-scales – a value of 0. Consequently, a total score of, for example, 17 (strong preference) on Medical Service reflects a score of 0 (no interest) on the opposite Enterprising/Helping pole, while a total score of 0 (no interest) on Medical Service indicates a maximum score of 17 on the Enterprising/Helping scale.

Apparently, the most important limitation of the ipsative nature of the JVIS is the uncertainty with regard to the validity of the PCA results. Several researchers pointed out that factor analysis of ipsative measures may merely reflect the artifactual bipolar nature of the scales rather than the true underlying factor structure (Cornwell & Dunlap, 1994; Loo, 1999). Consequently, factoring ipsative measures may produce meaningful, but invalid factor solutions (Cornwell & Dunlap, 1994; Johnson et al., 1988; Loo, 1999; Meade, 2004). Moreover, the fact that ipsative tests make it difficult, if not impossible, to draw valid and reliable comparison between individuals (Johnson et al., 1988) also jeopardize the results of the one-way analyses of variance and the independent t-tests which are dependent on inter-individual comparisons.

**Danger of translatory bias.** The validity and reliability of the results obtained by the PCA are highly dependent on the quality of the translation of the JVIS. Since high tetrachoric correlations between the variables depend entirely on the pattern of responses (see the Method section), the degree of comprehensibility of the statements are crucial elements in that respect. Specifically, some items might have lost their original meaning in the translation process. Several items could have been misread or misinterpreted, and as a result, chosen randomly instead of thoughtfully, or even not selected at all. If the inaccuracy of the translation had caused any kind of confusion among the respondents as to what kind of job activity or what kind of mode of behaviour a particular item actually referred to, it would subsequently also have influenced the whole response pattern, and the results of the analyses. The inventory was also not translated back to English, which is widely regarded as good methodological practice in the process of translation and adaptation of psychological tests (Reas, et al.; World Health Organization, 2011).

**Other limitations.** One of the biggest limitations of the current study is the sample size. Of course, 484 valid responses is a fairly high number, but taking into account the number of variables in the current study, it is not high enough. Nunnally (1978) recommend, for example, 10 times as many participants as variables. Jackson (2000) used samples of over 2,000 respondents. A small sample size probably also contributed to the problem of the non-positive definite and singular correlation matrix in the PCAs (Anderson & Gerbing, 1984**)**, even though the former problem was successfully dealt with.

It is also difficult to treat the sample as representative of the general student population , as several main study programmes were poorly represented (e.g. fine art) or not represented at all (e.g. economics). Moreover, only students from one of the Norwegian universities participated in the study. Vocational interests of students are also not necessarily representative of preferences of occupational groups or secondary school students. All things considered, the features of the sample used in the current study, put restriction on the results by making them less generalizable to the general student population and other populations.

Another possible limitation is the use of unequal sample sizes in in the one-way analyses of variance. Unequal sample sizes can affect the accuracy of *F*, especially if the assumption of normality has been violated (Field, 2013; Wilcox, 2012). With very small groups (e.g. medical students, $n = 38$), there is indeed a greater chance of kurtosis and skew distribution. According to the central limit theorem, if the sample is sufficiently large, the sampling distribution is approximately normal also under fairly week assumptions (Wilcox, 2012). The minimum sample size for the central limit theorem to be applicable is often defined as 30 (Field, 2013), so the sizes of all the six samples are within that lowest limit. The problem is that the central limit theorem also specifies that the sampling in question should be random (Wilcox, 2012), which is not entirely the case in the current study (see Method). Nevertheless, ANOVA is a robust test that apparently performs well in the face of violation of the non-normality assumption (Field, 2013). The study on binary data conducted by Lunney (1970) showed that, in case of unequal sample sizes, if the smaller response category contained less than 20 % of all responses, one needed at least 40 degrees of freedom for ANOVA to give errorless results. The current study complies with that rule. The problem of too small sample sizes might have also introduced bias in the correlational analyses, since the same student samples were used. Unequal sample sizes could also influence results of the independent t-tests, as the men were underrepresented, compared to women (337 females against 147 males) (see also Table C4).

A large number of items of the JVIS might also have had influenced the results. Reading 578 statements and deciding which item in each of 289 pairs should be selected can be a tiresome activity. Respondents will be more likely to omit many questions, and make very random, instead of carefully thought of, choices. The prize lottery might have also contributed to less precise responses, especially for those respondents whose only motive to participate in the study was the perspective of winning.

Finally, replacing missing values with the most frequent value for each variable might have had introduced bias to the data. However, taking into account the very low number of missing values (521 values out of total 139,839), there is little probability that this particular problem contributed to invalid results.

**Strengths of the study**

Before I go on to present strengths of the present study, there are pros of the JVIS that should not be disregarded. As pleaded by different vocational researchers (see e.g. Ashton & Goldberg, 1973; Goldberg & Slovic; Jackson, 1971, 2000; Savickas, 1999; Silvia, 2006), the fact that the inventory consists of conceptually developed scales makes it apparently more superior to measures developed empirically. Moreover, even though the pairing of items from different vocational interest scales puts constraints on how many possible scales of the translated JVIS one may determine in the PCA, this particular way of constructing an ipsative measure is advocated as a good solution to the problem of the negative multicollinearity of ipsative scales (Meade, 2004). The number of 34 scales in the American inventory also constitutes its strength. The more scales an ipsative measure consists of, the more valid the results obtained by ipsative data (Baron, 1996; Saville & Willson, 1991).

The preparation of the JVIS underwent an extensive development and research process to ensure the validity and reliability of the final product (Jackson, 2000). As a result, there is much support for the argument that the translated scales of the JVIS, which are similar to the American equivalents, are valid measures of vocational interests. Furthermore, even though the ipsative structure of the JVIS is cited as a crucial limitation, it should barely be treated as the weakness of the study. The ipsative format of the JVIS is *the main property of the inventory* which the current research tried to deal with as effectively as possible.

Researchers stress that factors obtained by ipsative measures are not meaningless, but only as long as proper statistical procedures are used (see e.g. Baron, 1996; Cornwell & Dunlap, 1994; Johnson et al., 1988; Meade, 2004). Therefore, the main strength of the current study is applying tetrachoric/polychoric correlations instead of Pearson's estimates in the

subsequent PCAs in order to test the component structure of the Norwegian version of the JVIS. As highlighted many times before, FA and PCA with binary variables, based on Pearson's correlation matrices, almost always produce misleading results (Basto & Pereira, 2012; see also Kubinger, 2003). Using ordinal alpha rather that Cronbach's alpha to estimate the reliability of the JVIS scales also speaks in favour of the study. Ordinal alpha seems superior to Cronbach's alpha, while analyzing the binary data. Using ordinal alpha might also have helped in avoiding the problem of invalid reliability coefficients obtained by ipsative data. Using PCA is generally also better than using FA (Cornwell & Dunlap, 1994).

Moreover, the extensive critique of factorizing ipsative measures mainly concentrates on factor analyzing scores on different ipsative scales (Cornwell & Dunlap, 1994; Johnson et al., 1988; Loo, 1999; Meade, 2004). However, the current study focused on analyzing pairs of items, not scores, by means of a PCA. The objective was to determine in subsequent analyses which scales the translated version consisted of, not to claim with certainty that they would be identical to their American equivalents. As a result, the scores were calculated after the main PCAs, and not before.

The study is not limited to the analysis of the component structure of the Norwegian version of the inventory. Several other hypotheses are also explored so as to make an initial attempt to use the JVIS scores as important criteria for predicting different outcomes, that is, differences in vocational interests between student groups, the level of academic and social satisfaction, and gender differences in vocational interests. Although not all the results gave support for the hypotheses, examining other phenomena on the basis of vocational interests contributes to the further exploration of the validity of the translated inventory. Moreover, the American version of the JVIS does not offer a score on Social Satisfaction, so testing the relationship between this scale and vocational interests was a new idea.

The translation of the JVIS was a crucial part of the study. Even though one may not entirely rule out the possibility of potential translatory bias, the translation process was very thorough (see the Translation subsection). It was not my intention to translate sentences literarily without taking into account linguistic and cultural differences between the Norwegian and the American population. The main objective was to provide a translation of the JVIS that would not only convey the meaning of the original items, but also eliminate any kind of translatory bias. The final product of the translation process should then be regarded as the strength rather than the weakness of the current study.

Following Field's recommendation (Field, 2013), I also bootstrapped the analyses to overcome possible bias, caused, for example, by unequal sample sizes. The only exception

was the general analyses of variance, since it is not possible to bootstrap them in SPSS (Field, 2013). The violation of the assumption of homogeneity of variance in ANOVA was corrected for by adjusting *F* to Welch's *F* (Field, 2013).

The strict criteria for valid responses (i.e. completion time and the number of missing values), applied to the data before the main analyses, had hopefully eliminated potential bias that might have been imposed on the data by the comprehensive format of the JVIS (i.e. 289 pair statements) and the prize lottery (i.e. answering at random in order to participate in the lottery). Indeed, the MCAR test (Little, 1988) showed that the most common pattern of missing data was ″missing completely at random″.

Finally, the R-menu used to conduct the PCAs was created by Basto and Pereira in 2012, so it is in many ways a brand-new tool. As mentioned in the Method section, some of the analyses were rerun in R to verify the correctness of the obtained results. The current study confirmed the usefulness and the validity of this specific SPSS dialog, which can be of importance for those researchers that would prefer to work with tetrachoric/polychoric correlations in the SPSS environment.

**Recommendations for future research**

Based on the discussed results and the presented limitations, several improvements to the current study should be considered in the future research on the translated JVIS. Some of the recommendations are similar to those given by Jackson (2000) in the JVIS manual (e.g. importance of vocational interests for career choices and satisfaction, and exploration of the career interests of men and women; see Jackson, 2000, for a full overview). There are also a number of directions for career counselling, but those will be discussed in the next subsection.

I have already described many problems caused by the forced-choice nature of the JVIS. One of them is that it renders it impossible to replicate the JVIS structure in the Norwegian culture, at least as long as one chooses to apply the same exploratory method for validating the instrument as the one used in the current study. Therefore, it will be interesting to explore the structure of the translated version using more sound modelling techniques (see e.g. Brown, & Maydeu-Olivares, 2013; Jackson & Alwin, 1980; Meade, 2004). Nevertheless, applying different methods to the ipsative format of the JVIS would not eliminate the problem of the bipolarity of the data. The solution focusing on the transformation of the Norwegian version of the JVIS into Likert item format will in many ways improve the psychometric qualities of the inventory, since it will give more meaningful and uniform

components. In fact there seem so many weaknesses related to the forced-choice format of the JVIS that this kind of permanent alternation may be treated as the most important recommendation for future research. After all, many researchers have long treated normative measures (e.g. Likert scaling) as psychometrically superior to the ipsative (Cornwell & Dunlap, 1994; Johnson et al., 1988; Loo, 1999; Meade, 2004).

I do not claim that a forced-choice format of vocational interest inventories is useless and invalid. Making career choices can often take a forced-choice form by compelling people to resort to their personal preferences so as to make the optimal vocational choices based on several available options. The argument that ipsative measures reflect the position that life is about choices is also cited as one of the most important reasons for using forced-choice formats in psychological testing (Baron, 1996; Saville & Willson, 1991). Thus reconstructing the JVIS into the normative Likert format will in a way undermine the original idea of using the forced-choice format to reflect the ″either or″ career choices. Moreover, while the ipsative tests are not recommended in some contexts (e.g. in employee selection), measuring vocational interests in an ipsative way may be more advisable than using normative methods (Meade, 2004).

On the other hand, the process of choosing a career path out of different available options is not synonymous with the process of ticking off items describing specific vocational preferences at the expense of other possible options. Career choices are often more complex. They are based on several factors and the interplay of many, both complementary and contradictory, vocational interests. As suggested previously, people's vocational preferences will probably be better expressed by a rating rather than a ranking ″most like me″ and ″least like me″ system. Other researchers should then focus on the improvement of the JVIS by taking the above-mentioned Likert transformation into consideration. The transformation of the JVIS into the Jackson Career Explorer, which was done by Schermer & Vernon (2008), can serve as a good example in this context.

The other important recommendation for future research is further validation of the Norwegian version of the JVIS in a substantially bigger and more representative sample. Before taking 19 scales obtained in the current study for granted or reject them as invalid, vocational researchers should administer the inventory to, for example, members of different occupational groups and secondary school students. It will be interesting to check if the same scales will appear in a PCA, and if the same variables will have to be omitted. For example, the scales describing activities in law and finance, which are meaningful and equivocal in the

original version of the JVIS, did not emerge in the Norwegian test. Could this be explained by the fact that no students majoring in law or economy participated in the study?

Studies with bigger and more representative samples could also enable researchers to make better estimations of concurrent and predictive validity of the JVIS for different occupational and academic outcomes (e.g. job satisfaction, academic satisfaction, social satisfaction, performance, and future career choices). When it comes to the student satisfaction scales, it is advisable to test if the significant relationship between these variables and vocational interests would exist in more homogenous student samples than the ones used in the current study. It was, for example, demonstrated that Social Science correlated significantly with Academic Satisfaction in the uniform sample of psychology students, but not in the very diverse sample of social science students.

The inclusion of several other student groups, and specific occupational groups would also help to establish academic clusters and job groups. The general profile of those groups could then be used to compare profiles of respondents with that of a particular academic or job cluster in the same manner as it is done in the American version of the JVIS (Jackson, 2000). Looking at the response patterns of the student groups represented by their mean scores on the JVIS scales in Table C3, the current study gives just a foretaste of how profiles of different student groups might look like.

The ″bigger and more representative sample″ recommendation is as valid for those researchers who would like to work with the transformed Likert version of the JVIS, as for those who insist on complying with the ipsative format of the inventory. Generally, bigger and representative samples will contribute to more generalizable results regardless of what hypotheses researchers would choose to test.

Both the proponents of ipsative or normative measures should probably also reconsider using as many as 578 statements in the inventory. The inspection of component or factor loadings may reveal which items would be most meaningful to include if one was to test the inventory anew. The results of the PCAs in the current study also indicate which statements might be the most prominent, and which should be omitted. Fewer JVIS items used in future studies will require a smaller number of respondents to conduct a PCA, which may be a huge advantage if one does not have access to very big samples.

There are also good reasons for updating some of the statements, or even supplement the inventory with the items that are more relevant for the Norwegian work life. Specific items, such as for example ″operating power looms in a textile factory″, may seem outdated and no longer relevant, especially for the young population. Additionally, the JVIS does not

include any items that refer to job activities involving working with modern technologies. Integrating new items or removing the obsolete ones would naturally imply verifying the component structure of the JVIS anew. Translation of the inventory back to English is also a possibility future researchers might consider. However, a possible drawback of the back-translation should then been given careful consideration to, namely, that important cultural differences are more likely to be downplayed at the expense of the linguistic accuracy

I previously discussed the ambivalent nature of the work style scales. Do they reflect vocational preferences for working in a particular work environment, or are they more closely related to other psychological constructs (e.g. personality)? The answer to this question may be determined by correlating work style items with valid and reliable personality scales (e.g. NEO PI-R domains and facets, Costa & McCrae, 1992). I do not try to devaluate the inclusion of the items measuring work styles in the inventory. Choosing a career is after all not only about identifying job activities that are the best match for an individual's interests, but also about examining which work environments constitute the optimal fit to her or his preferences. Yet, careful investigation of each of work style items may reveal if they in fact measure vocational interests, or if they jeopardize the content validity of the test.

Moreover, the way in which the JVIS is constructed, allows for several items belonging to the work role scales to be combined with items belonging to work style scales, even though they apparently measure different aspects of vocational interests. The inventory structure could possibly be improved by matching the work style items with one another instead of mixing them with the work role items. Researchers may also wish to reconsider the potentially ″disturbing and incongruous″ (Juni & Koenig, 1982) pairing of the JVIS statements that seem to describe very different occupational phenomena.

Vocational interests are treated as long-term dispositional traits that influence behaviour through personal preferences for specific work activities and work environments (Mount et al. (2005); Van Iddekinge et al., 2011). Strong (1955) noticed the pattern of interests was quite stable from adolescence throughout a lifetime. Super (1949) also argued for a stable pattern of vocational interests throughout a lifetime. It is absolutely worthwhile to check if vocational interests measured by the Norwegian version of the JVIS remain stable over time. In fact, the ability of the vocational interest scales to produce the same results will strengthen its reliability. The best way to check if there is any discrepancy in obtained measures is to administer the test to the same group of people at two points in time, that is, to verify its *test–retest reliability* (Field, 2013). Administering the JVIS to students in their last

year of the secondary school, and then again to the same group some months later is an example of the research design to examine the stability of the JVIS.

The analyses used to test Hypothesis 3 were exclusively correlational. As discussed above, they did not say anything about which variable caused the other to change (Field, 2013 Field et al., 2012). Establishing causal relationships requires other statistical methods, for example, simple regression or multiple regression analyses. The latter analysis enables researchers to hold the effect of other variables that might influence the outcome constant (Field, 2013; Field et al., 2012). Controlling for other variables can reveal what factors in reality influence academic satisfaction and social satisfaction, and how much variance in student satisfaction can be contributed to vocational interests. It may also help to eliminate any confounding variables in the analyses. The future research focusing on the cause-effect relationships between vocational interests and various dependent variables (e.g. satisfaction measures) and on several other possible covariates should give more conclusive results than those obtained while testing Hypothesis 3.

One of the variables that seems to be especially interesting in this context is occupational prestige. The spherical model which was developed as an alternative to Holland's hexagon (Tracey & Rounds, 1995, 1996) includes the prestige dimension as an important, but consistently neglected (Rounds & Zevon, 1983), element of vocational interest structure. Prestige may indeed play an important part in career choices, especially for people who pursue higher education. Testing if level of prestige influences educational and vocational preferences, and has an effect on job satisfaction, are interesting research topics.

Based on the results of the independent t-tests, there is evidence that there are gender differences in vocational interests, even though the differences were small to moderate. However, the results just indicate where the main differences lie. They are not indicative of why they exist. There is, for example, still much controversy regarding the underrepresentation of women in math-intensive fields (Ceci et al., 2009; Schreiner, 2006, 2008; Ramberg, 2006). Genetic aspect seems important, for instance, based on the results of genetic analysis of vocational interests conducted by Schermer & Vernon (2008). Other factors, such as, for misinformation regarding female- and male-dominated occupations, social structure, gender equality and family politics, social and cultural expectations, or ineffective recruiting methods may be equally valid explanation for existing gender disparities. This study gives good reasons for future research to address these issues in more detail. Exploring gender differences in other vocational interests and in other more

representative samples, could give a more precise answer to what kind of gender differences in vocational interests are present in the Norwegian population, and what factors cause them.

Last, but not least, future researchers that wish to explore vocational interest differences between several other student groups should consider using equal sample size, as well, so as to avoid the problems in ANOVA that already have been discussed. If groups with equal number of respondents are hard to obtain, there are more robust ANOVA tests available, for example, in R (Field et al., 2012).

**Recommendations for vocational counselling**

Vocational interests may play an important role in academic and occupational choices (Ceci et al., 2006; Ramberg, 2008; Schreiner, 2006, 2008; Su et al., 2009). For that reason, the importance of vocational interests should not be understated in vocational counselling. Good interest inventories may also contribute to more effective and successful career guidance. The current, preliminary study gives evidence for the high validity and reliability of several JVIS scales. In other words, the results indicate that the translated inventory may indeed be a useful tool in vocational counselling. However, the successful career guidance by means of the Norwegian version of the JVIS is very much dependent on the results produced by future research on the structure of the inventory. The inventory does require further validation and retesting in other samples before it can be employed by counsellors.

Interests measured by the JVIS are inventoried interests. The scores can be only used to indicate weak, average or strong preference for different job activities in much the same way as in Strong (1955) and Kuder (Mosier & Kuder, 1949). They do not capture cognitive, emotional, motivational or behavioral aspects of vocational preferences (Savickas, 1999) (e.g. motivation to remain in a specific job or behaviour an individual will display in a particular work environment). Neither do they say why some activities are more preferred than others. Vocational interest inventories are also not personality inventories even though Holland (1999) suggested that.

The responses obtained on the JVIS can be summed to produce scaled scores on a standardized profile that represent an individual's vocational interests (Crites, 1999; Darley, 1938; Spokane & Decker, 1999). That profile can be subsequently compared to that of a specific normative group in order to identify which occupations or study problems match a counselle's interest patter. Consequently, a career counsellor could offer better advice on which major or career an individual should pursue. However, what kind of normative groups, that is, occupational and academic clusters, one can find in the Norwegian population has yet

to be determined. More consistent results for the relationship between the JVIS scores and different work- or study-related outcomes could also contribute to more informed career guidance by allowing counsellors to make predictions regarding future academic satisfaction, social satisfaction, or job satisfaction on the basis of scores of a counsellee. However, the JVIS should first and foremost be treated as a career exploration and planning tool, and not as an instrument measuring the degree of similarity between counsellees' preferences and those of people in different occupations or majors (Jackson, 2000; Murphy & Davidshofer, 2005). This property of the inventory may be of great value in counselling people that do not have well-defined vocational interests. Taking the JVIS may help those counsellees to come to sudden realization of their own vocational interests. It may also be useful for individuals that want to be ″everything″ by aiding them to narrow down their vocational interests in order to make more pragmatic job choices. Taking into account the argument made by Johnson et al. (1988) to use ipsative inventories only for intra-individual comparisons, this particular property of the JVIS may be of great importance for vocational advisors.

Jackson (2000) stressed that the JVIS only focused on measured interests. Yet, several psychologists have pointed out that there exists a great disparity in results originating from measured and expressed interests (Borgen & Seling, 1978; Dolliver, 1969; Spokane & Decker, 1999). In consequence, they postulated the assessment of both types of interests in vocational counselling (Hartung, 1999; Spokane & Decker, 1999). Even though the JVIS does not include any open questions that could help a career counsellor to investigate expressed interests of a counsellee, this should hardly be treated as a weakness. While measured interests measure vocational interests, at least such as they are understood and interpreted in vocational psychology, expressed interests seem to measure intended actions rather than vocational interests (Silvia, 2006). Therefore, it is not so surprising that statements of intended career choices predict career choice better than scores on an interest inventory (Silvia, 2006). Combining measured and expressed interests, where the latter are understood as measures of intentions or future plans, and not vocational interests, may in fact weaken validity of vocational interest inventories.

Nevertheless, it is highly expedient to ask direct questions about a counsellee's dream job and future plans during a counselling session. Vocational interests are not the only factors that may affect academic and occupational choice. Career counsellors should always consider, together with a counsellee, other beneficial and detrimental factors that may affect her or his academic and occupational choices, even if this kind of exploration will lead to career advice or a career choice that go against the results obtained in the JVIS. Not

everybody will get the possibility of having a job that would totally complement her or his interests. Some people have to make pragmatic choices based on their abilities, skills, personal values, educational level, environmental factors (e.g. the place they live in or want to move to), family situation, cultural background, or even physical condition.

All in all, devaluating the JVIS results, because of their dissimilarity with expressed interests and lower predictability of job choice in comparison with expressed interests, seems hardly advisable. Conversely, treating the JVIS scores as the alpha and omega of a person's vocational interests and career possibilities, while disregarding what the person actually says during a counselling session, is hardly a sign of good career guidance. It is also poor counselling practice to narrow a counsellee's focus too early to consideration of a particular career path, based on, for example, very high basic interest scale scores (Jackson, 2000). It is important in vocational decision to review activities of interest (high scores), but also areas of work one may wish to avoid (low scores) (Jackson, 2000). This kind of informed guidance can help an individual to make realistic and reasonable decisions.

As presented in the Theory section, there is a weak to moderate relationship between vocational interests and abilities (Lent er al., 1994; Savickas, 1999; Silvias, 2006; Strong, 1943; Walsh, 1999). Consequently, a low or high score on the JVIS vocational interest scales does not tell anything about an individual's future success in a specific area of study, or a specific field of work. Nor does it reveal much about the person's prospective performance (Jackson, 2000). Career counsellors should always consider if a counsellee has necessary skills, abilities or physical predispositions to pursue most desired occupations. Focusing on other psychological constructs, for example, personality traits and self-efficacy can also contribute to more realistic career advices and career choices. The researchers have demonstrated that combining measures of vocational interests with aptitudes (Lubinski & Benbow, 2006; Robertson et al., 2010; Savickas & Spokane, 1999), personality (Ackerman and Heggestad, 1997; Mount et al., 2005) and self-efficacy (Lent et al., 1994) improves educational and vocational counselling.

As described in the Theory section, there are several interest inventories that incorporate aptitude measurements, for instance the Self-Directed Search, or the Norwegian *Veivalg* and *Solbergs interesstetest*. The JVIS does not contain a list of self-assessed abilities. Respondents are actually asked to disregard whether or not they have the necessary training in or experience with the presented job-related activities (Jackson, 2000). This specific quality of the inventory hardly constitutes a weakness. Studies of self-assessed aptitudes demonstrate that people rarely manage to judge their abilities accurately and competently

(Kruger & Dunning, 1999; Sedikides & Strube, 1997). Moreover, vocational interest inventories are constructed to measure vocational preferences, not other psychological attributes. Asking people to appraise their own skills and competencies in a specific area does not have much to do with vocational interests. Including self-assessed measures of ability in vocational interest inventories may therefore weaken their validity. However, objective measures of abilities, such as aptitude inventories, or most preferably tests based on concrete work tasks or work problems an individual may encounter in a workplace, which are better ″estimates″ of factual abilities, can be a good supplement to vocational interest inventories in a vocational counselling situation.

All scales of the JVIS are sex-balanced, which means they are designed to be equally appropriate for men and women (Jackson, 2000). Nevertheless, it does not mean that sex differences in vocational interests should be downplayed in a counselling situation. Nor should they be blown out of proportions. After all, the effect sizes were mostly small in the current study. However, the existing gender differences may alter the way of understanding career choices among men and women. They may, among others, have important implications for how a career advisor interprets and discusses the results with a female or a male client. For example, a score of 12 on Mathematical Reasoning for a female client will be regarded as an average score in the whole student population ($M$ = 12.00), but as a ″higher than average″ score if one just focuses on the general mean score of the female population ($M$ = 10.62). Conversely, a score of 6.00 on Social Service for a male client may be treated as lower than the mean score in the whole student population ($M$ = 5.97), but ″higher than average″ if the counsellor uses only the male population as a reference group ($M$ = 4.61). There are also other dilemmas that may occur based on possible sex differences. Should one encourage female or male counsellees to pursue careers in male-dominated industries, or female-dominated positions so as to contribute to the greater gender balance in these professions, even though his or her preferences go in different directions? Which factors will constitute good and informed counselling situation that will encourage men and women to make conscious and untraditional career choices? Exploring untraditional career choices with male and female counsellees, promoting vocational interests in work activities that may go against expectations of what male and female occupations are, and successive follow-ups of the counsellees may be important elements in this context.

The scoring process used to present the results to the counsellee should also be reconsidered. It may be very confusing to a particular individual to understand that a minimum score of 0 on one of the scales reflects a maximum score of 17 on the scale that

constitutes its other pole. If a person has a low score on for example Medical Service, it indicates that he or she is more interested in activities on the opposite side of this scale, that is, in Enterprising or Helping activities. It may be difficult for a counsellee to understand that he or she shows a weaker preference for Medical Service than Enterprising/Helping activities. Are Medical Service not about helping, or undertaking ambitious and challenging tasks? To avoid confusion of what different occupational scales (or themes) actually refer to, it will always be important to explain to the respondent what kind of vocational interests they actually describe, and which kind of specific activities they refer to. The type of coding used in the current study is not the most comprehensible if one wishes to discuss the results with a respondent. Subtracting the mean score on a particular A- or B-scale from the total score is also a method that could result in more intelligible scores on the scales representing opposite poles.

## Conclusive remarks

The current study is certainly the first, but hopefully not the last scientific inquiry into the structure of the Norwegian version of the JVIS. Based on the presented results, there is initial evidence for good validity and reliability of the obtained scales. Many of the analyzed vocational interests were also strongest for the expected student groups. However, further exploration of content and concurrent validity of the inventory is necessary, especially with reference to the importance of vocational interests for student satisfaction. The study also gives support for small to moderate sex differences in vocational interests which other researchers may wish to investigate in more detail. Future research on the Norwegian JVIS should also evaluate the discussed weaknesses and strengths of both the present study and the JVIS. The ipsative format of the JVIS and a relatively small sample size seem to be the most important issues in that context.

The importance of vocational interests for career choices has been appraised in vocational psychology and career advising for a long time In the face of rapid changes on the global work market that both encourage and force many people to frequent career changes, successful vocational counselling seems even more important than ever. Good interest inventories could without a doubt make a contribution to more effective, realistic and informed career guidance. I hope this study will inspire vocational researchers to focus more on the nature of vocational interests, and the development of reliable and valid vocational interest inventories, under scientific rather than commercial incentives. The supplementary studies of the Norwegian version of the JVIS represent here a good starting point.

## References


Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: Evidence for overlapping traits. *Psychological Bulletin*, *121*, 219–245. doi:10.1037/0033-2909.121.2.219

Anderson, J. C., & Gerbing, D. W. (1984). The effect of sampling error on convergence, improper solutions, and goodness-of-fit indices for maximum likelihood confirmatory factor analysis. *Psychometrika*, *49*, 155–173. doi:10.1007/BF02294170

Armstrong, P. I., Day, S. X., McVay, J. P., & Rounds, J. (2008). Holland's RIASEC model as an integrative framework for individual differences. *Journal of Counseling Psychology*, *55*, 1–18. doi:10.1037/0022-0167.55.1.1

Arnold, F. (2010). *Attention and interest: A study in psychology and education.* Retrieved from https://archive.org/details/attentionandint00arnogoog

Ashton, S. G., & Goldberg, L. R. (1973). In response to Jackson's challenge: The comparative validity of personality scales constructed by the external (empirical) strategy and scales developed intuitively by experts, novices, and laymen. *Journal of Research in Personality*, *7*, 1–20. doi:10.1016/0092-6566(73)90028-7

Barak, A., & Cohen, L. (2002). Empirical examination of an online version of the Self-Directed Search. *Journal of Career Assessment*, *10*, 387–400. doi:10.1177/1069072702238402

Bartholomew, D. J., Steele, F., Moustaki, I., & Galbraith, J. I. (2008). *Analysis of multivariate social science data* (2nd ed.). Retrieved from http://www.crcnetbase.com/doi/book/10.1201/b15114

Barrick, M. R., Mount, M. K., & Gupta, R. (2003). Meta-analysis of the relationship between the five-factor model of personality and Holland's occupational types, *Personnel Psychology*, *56*, 45–74. doi:10.1111/j.1744-6570.2003.tb00143.x

Baron, H. (1996). Strengths and limitations of ipsative measurement. *Journal of Occupational and Organizational Psychology*, *69*, 49–56. doi:10.1111/j.2044-8325.1996.tb00599.x

Basto, M., & Pereira, J. M. (2012). An SPSS R-Menu for ordinal factor analysis. *Journal of Statistical Software*, *46*(4), 1–29. Retrieved from http://www.jstatsoft.org/v46/i04/paper

Bentler, P. M. (1972). A lower-bound method for the dimension-free measurement of internal consistency. *Social Science Research*, *1*, 343–357.

doi:10.1016/0049-089X(72)90082-8

Berlyne, D. E. (1954a). A theory of human curiosity. *British Journal of Psychology*, *45*, 180–191. doi:10.1111/j.2044-8295.1954.tb01243.x

Berlyne, D. E. (1954b). An experimental study of human curiosity. *British Journal of Psychology*, *45*, 256–265. doi:10.1111/j.2044-8295.1954.tb01253.x

Berk, L. A., & Fekken, G. C. (1990). Person reliability evaluated in the context of vocational interest assessment. *Journal of Vocational Behavior*, *37*, 7–16. doi:10.1016/0001-8791(90)90003-K

Bernaards, C., & Jennrich, R. (2012). GPArotation: GPA Factor Rotation [R package version 2012.3-1]. Retrieved from http://cran.r-project.org/web/packages/GPArotation/index.html

Betz, N., & Fitzgerald, L. F. (1987). *The career psychology of women*. Orlando, FL: Academic Press.

Borgen, F. H., & Seling, M. J. (1978). Expressed and inventoried interests revisited: Perspicacity in the person. *Journal of Counseling Psychology*, *25*, 536–543. doi:10.1037/0022-0167.25.6.536

Brown, A., & Maydeu-Olivares, A. (2013). How IRT can solve problems of ipsative data in forced-choice questionnaires. *Psychological Methods*, *18*, 36–52. doi:10.1037/a0030641

Campbell, D. P. (1971). *Handbook for the Strong Vocational Interest Blank*. Stanford: Stanford University Press.

Ceci, S. J., Williams, W. M., & Barnett, S. M. (2009). Women's underrepresentation in science: Sociocultural and biological considerations. *Psychological Bulletin*, *135*, 218–261. doi:10.1037/a0014412

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*, 155–159. doi:10.1037/0033-2909.112.1.155

Cohen, L., & Holliday, M. (1996). *Practical statistics for students: An introductory text.* London: Paul Chapman Publishing Ltd.

Cole, N. S., Whitney, D. R., & Holland, J. L. (1971). A spatial configuration of occupations. *Journal of Vocational Behavior*, *1*, 1–9. doi:10.1016/0001-8791(71)90002-9

Cornwell, J. M., & Dunlap, W. P. (1994). On the questionable soundness of factoring ipsative data: A response to Saville & Willson (1991). *Journal of Occupational and Organizational Psychology*, *67*, 89–100. doi:10.1111/j.2044-8325.1994.tb00553.x

Costa, P. T., & McCrae, R. R. (1992). Normal personality assessment in clinical practice: The NEO Personality Inventory. *Psychological Assessment*, *4*, 5–13. doi:10.1037/1040-3590.4.1.5

Costa, P. T., McCrae, R. R., & Holland, J. L. (1984). Personality and vocational interests in an adult sample. *Journal of Applied Psychology*, *69*, 390–400. doi:10.1037/0021-9010.69.3.390

Courtney, R., & Gordon, M. (2013). Determining the number of factors to retain in EFA: Using the SPSS R-Menu v2.0 to make more judicious estimations. *Practical Assessment, Research & Evaluation*, *18*(8), 1–14. Retrieved from http://www.pareonline.net/pdf/v18n8.pdf

Crites, J.O. (1999). Operational definitions of vocational interests. In M. L. Savickas & A. R. Spokane (Eds.), *Vocational interests: Meaning, measurement, and counseling use* (pp. 163–170). Palo Alto, CA: Davies-Black Publishing.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*, 297–334. doi:10.1007/BF02310555

Cronbach, L. J., & Shavelson, R. J. (2004). My current thoughts on coefficient alpha and successor procedures. *Educational and Psychological Measurement*, *64*, 391–418. doi:10.1177/0013164404266386

Dalzell, C. (2013, October 31). Calling R from SPSS: An introduction to the R plug-in for SPSS [Web article: Copyright by IBM Cooperation 2013]. Retrieved from http://www.ibm.com/developerworks/library/ba-call-r-spss/

Darley, J. G. (1938). A preliminary study of relations between attitude, adjustment, and vocational interest tests. *Journal of Educational Psychology*, *29*, 467–473. doi:10.1037/h0061063

Day, S. X., & Rounds, J. (1998). Universality of vocational interest structure among racial and ethnic minorities. *American Psychologist*, *53*, 728–736. doi:10.1037/0003-066X.53.7.728

Dewey, J. (1913). *Interest and effort in education.* Retrieved from https://archive.org/details/interestandeffor00deweuoft

Digman, J. M. (1997). Higher-order factors of the Big Five. *Journal of Personality and Social Psychology*, *73*, 1246–1256. doi:10.1037/0022-3514.73.6.1246

Dolliver, R. H. (1969). Strong Vocational Interest Blank versus expressed vocational interests: A review. *Psychological Bulletin*, *72*, 95–107. doi:10.1037/h0027850

Einarsdóttir, S., Rounds, J., Ægisdóttir, S., & Gerstein, L. H. (2002). The structure of vocational interests in Iceland: Examining Holland's and Gati's RIASEC models. *European Journal of Psychological Assessment*, *18*, 85–95. doi:10.1027//1015-5759.18.1.85

Farmer, R., & Sundberg, N. D. (1986). Boredom proneness – the development and correlates of a new scale. *Journal of Personality Assessment*, *50*, 4–17. doi:10.1207/s15327752jpa5001_2

Ferreira, J. A. A., & Hood, A. B. (1995). The development and validation of a Holland-type Portuguese Vocational Interest Inventory. *Journal of Vocational Behavior*, *46*, 119–130. doi:10.1006/jvbe.1995.1008

Field, A. (2013). *Discovering statistics using IBM SPSS Statistics* (4th ed.). Los Angeles: SAGE Publications.

Field, A., Miles, J, & Field Z. (2012). *Discovering statistics using R*. Los Angeles: SAGE Publications.

Fisher, C. D., & Noble, C. S. (2004). A within-person examination of correlates of performance and emotions while working. *Human Performance*, *17*, 145–168. doi:10.1207/s15327043hup1702_2

Fiske, J., & Berge, J.-M. Yrkesvalgpsykologi – teoretiske modeller og kliniske problemstillinger. *Tidskrift for Norsk Psykologiforening*, *48*, 751–757. Retrieved from http://www.psykologtidsskriftet.no/index.php?seks_id=149005&a=2

Fouad, N. A. (2007). Work and vocational psychology: Theory, research, and applications. *Annual Review of Psychology*, *58*, 543–564. doi:10.1146/annurev.psych.58.110405.085713

Fox, J. (2010). polycor: Polychoric and Polyserial Correlations [R package version 0.7-8]. Retrieved from http://CRAN.R-project.org/package=polycor

Furnham, A. (2001). Vocational preference and P–O fit: Reflections on Holland's theory of vocational choice. *Applied Psychology*, *50*, 5–29. doi:10.1111/1464-0597.00046

Furnham, A. (2005). *The psychology of behaviour at work: The individual in the organization* (2nd ed.). Hove: Psychology Press.

Furnham, A., & Schaeffer, R. (1984). Person-environment fit, job satisfaction and mental health. *Journal of Occupational Psychology*, *57*, 295–307. doi:10.1111/j.2044-8325.1984.tb00170.x

Furnham, A., Toop, A., Lewis, C., & Fisher, A. (1995). P–E fit and job satisfaction: A failure to support Holland's theory in three British samples. *Personality and Individual Differences*, *19*, 677–690. doi:10.1016/0191-8869(95)00091-J

Gadermann, A. M., Guhn, M., & Zumbo, B. D. (2012). Estimating ordinal reliability for Likert-type and ordinal item response data: A conceptual, empirical, and practical guide. *Practical Assessment, Research & Evaluation*, *17*(3), 1–13. Retrieved from http://pareonline.net/pdf/v17n3.pdf

Gati, I. (1979). A hierarchical model for the structure of vocational interests. *Journal of Vocational Behavior*, *15*, 90–106. doi:10.1016/0001-8791(79)90021-6

Gati, I. (1991). The structure of vocational interests. *Psychological Bulletin*, *109*, 309–324. doi:10.1037/0033-2909.109.2.309

Goldberg, L. R., & Slovic, P. (1967). Importance of test item content: An analysis of a corollary of the deviation hypothesis. *Journal of Counseling Psychology*, *14*, 462–472. doi:10.1037/h0024933

Gottfredson, G. D., & Holland, J. L. (1975). Vocational choices of men and women: A comparison of predictors from the Self-Directed Search. *Journal of Counseling Psychology*, *22*, 28–34. doi:10.1037/h0076150

Harp, S. F., & Mayer, R. E. (1997). The role of interest in learning from scientific text and illustrations: On the distinction between emotional interest and cognitive interest. *Journal of Educational Psychology*, *89*, 92–102. doi:10.1037/0022-0663.89.1.92

Hartung, P. J. (1999). Interest assessment using card sorts. In M. L. Savickas & A. R. Spokane (Eds.), *Vocational interests: Meaning, measurement, and counseling use* (pp. 235–252). Palo Alto, CA: Davies-Black Publishing.

Hellevik, O. (2009, March). Spørreundersøkelser [Web article]. Retrieved from The Norwegian National Committees for Research Ethics website: http://www.etikkom.no/FBIB/Introduksjon/Metoder-og-tilnarminger/Sporreundersokelser/

Helsedirektoratet, The Norwegian Directorate of Health (2011, December). *Arbeid er viktig for psykisk helse*. Retrieved from http://helsedirektoratet.no/psykisk-helse-og-rus/psykisk-helsearbeid/arbeid-og-psykisk-helse/forebygging/Sider/arbeid-er-viktig-for-den-psykiske-helsen.aspx

Higham, N. J. (2002). Computing the nearest correlation matrix—a problem from finance. *IMA Journal of Numerical Analysis*, *22*, 329-343. doi:10.1093/imanum/22.3.329

Hogan, R., & Blake, R. (1999). John Holland's vocational typology and personality theory. *Journal of Vocational Behavior*, *55*, 41–56. doi:10.1006/jvbe.1999.1696

Holland, J. L. (1973). *Making vocational choices: A theory of careers*. Englewood Cliffs, NJ: Prentice-Hall.

Holland, J. L. (1985). *Making vocational choices: A theory of vocational personalities and work environments* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments* (3rd ed.). Odessa, FL: Psychological Assessment Resources.

Holland, J. L. (1999). Why interest inventories are also personality inventories. In M. L. Savickas & A. R. Spokane (Eds.), *Vocational interests: Meaning, measurement, and counseling use* (pp. 87–101). Palo Alto, CA: Davies-Black Publishing.

Holland, J. L., Whitney, D. R., Cole, N. S., & Richards, J. M. (1969). *An empirical occupational classification derived from a theory of personality and intended for practice and research* (ACT Research Report No. 29). Retrieved from ERIC Institute of Educational Sciences website: http://files.eric.ed.gov/fulltext/ED031194.pdf

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, *30*, 179–185. doi:10.1007/BF02289447

Hutcheson, G, & Sofroniou, N. (1999). *The multivariate social scientist*. Retrieved from http://site.ebrary.com/lib/ntnu/docDetail.action?docID=10369662

IBM Cooperation. (2012a). IBM SPSS Statistics 21 [Computer software]. Armonk, NY: IBM Corporation. Retrieved from http://www-01.ibm.com/software/analytics/spss/

IBM Cooperation. (2012b). *Working with R* [Software manual]. Armonk, NY: IBM Corporation. Retrieved from http://nt-06660:51014/help/index.jsp?topic=/com.ibm.spss.statistics.r.tut/rtut_intro.htm

Jackson, D. J., & Alwin, D. F. (1980). The factor analysis of ipsative measures. *Sociological Methods & Research*, *9*, 218–238.doi:10.1177/004912418000900206

Jackson, D. N. (1971). The dynamics of structured personality tests: 1971. *Psychological Review*, *78*, 229–248. doi:10.1037/h0030852

Jackson, D. N. (2000). *Jackson Vocational Interest Survey manual* (2nd ed.). Port Huron, MI: SIGMA Assessment Systems.

Jackson, D. N., Holden, R. R., Locklin, R. H., & Marks, E. (1984). Taxonomy of vocational interests of academic major areas. *Journal of Educational Measurement*, *21*, 261–275. doi:10.1111/j.1745-3984.1984.tb01033.x

Jackson, D. N, Williams, D. R. (1975). Occupational classification in terms of interest patterns. *Journal of Vocational Behavior*, *6*, 269–280. doi:10.1016/0001-8791(75)90053-6

Jigău, M. (2007). Jackson Vocational Interest Survey (JVIS). In M. Jigău (Ed.), *Career counselling: Compendium of methods and techniques* (pp. 71–83). Retrieved from http://www2.rajaleidja.ee/public/Suunaja/Career_Counselling._Compendium_of_Methods_and_Techniques.pdf

Johnson, C. E., Wood, R., & Blinkhorn, S. F. (1988). Spuriouser and spuriouser: The use of ipsative personality tests. *Journal of Occupational Psychology*, *61*, 153–162. doi:10.1111/j.2044-8325.1988.tb00279.x

Juni, S., & Koenig, E. J. (1982). Contingency validity as a requirement in forced-choice item construction: A critique of the Jackson Vocational Interest Survey. *Measurement & Evaluation in Guidance*, *14*(4), 202–207.

Kaiser, H. F. (1970) A second generation little jiffy. *Psychometrika*, *35*, 401–415. doi:10.1007/BF02291817

Kaiser, H. F. (1974). The index of factorial simplicity. *Psychometrika*, *39*, 31–36. doi:10.1007/BF02291575

Kashdan, T. B., Rose, P., & Fincham, F. D. (2004). Curiosity and exploration: Facilitating positive subjective experiences and personal growth opportunities. *Journal of Personality Assessment*, *82*, 291–305. doi:10.1207/s15327752jpa8203_05

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, *77*, 1121–1134. doi:10.1037/0022-3514.77.6.1121

Kubinger, K. D. (2003). On artificial results due to using factor analysis for dichotomous variables. *Psychology Science*, *45*(1), 106–110. Retrieved from http://www.pabst-publishers.de/psychology-science/1-2003/pdf_06.pdf?origin=publication_detail

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, *45*, 79–122. doi:10.1006/jvbe.1994.1027

Lent, R. W., Singley, D., Sheu, H.–B., Gainor, K. A., Brenner, B. R., Treistman, D., & Ades, L. (2005). Social cognitive predictors of domain and life satisfaction: Exploring the theoretical precursors of subjective well-being. *Journal of Counseling Psychology*, *52*, 429– 442. doi:10.1037/0022-0167.52.3.429

Lent, R. W., Singley, D., Sheu, H.–B., Schmidt, J. A., & Schmidt, L. C. (2007). Relation of social-cognitive factors to academic satisfaction in engineering students. *Journal of Career Assessment*, *15*, 87–97. doi:10.1177/1069072706294518

Lippa, R. (1998). Gender-related individual differences and the structure of vocational interests: The importance of the people–things dimension. *Journal of Personality and Social Psychology, 74,* 996–1009. doi:10.1037/0022-3514.74.4.996

Lippa, R. (2001). On deconstructing and reconstructing masculinity–femininity. *Journal of Research in Personality, 35,* 168–207. doi:10.1006/jrpe.2000.2307

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values, *Journal of the American Statistical Association*, *83*, 1198–1202. Retrieved from http://www.jstor.org/stable/2290157

Little, R. J. A., & Rubin, D. B. (1989). The analysis of social science data with missing values. *Sociological Methods & Research*, *18*, 292–326. doi:10.1177/0049124189018002004

Locklin, R. H. (1976). Predicting choice of academic college from JVIS scores of college freshmen. University Park, PA: Undergraduate Student Research Support, The Pennsylvania State University Research Bulletin. Abstract retrieved from http://eric.ed.gov/?id=ED205132

Loo, R. (1999). Issues in factor-analyzing ipsative measures: The Learning Style Inventory (LSI-1985) example. *Journal of Business and Psychology*, *14*, 149–154. Retrieved from http://link.springer.com/article/10.1023%2FA%3A1022918803653

Lubinski, D., & Benbow, C. P. (2006). Study of mathematically precocious youth after 35 years: Uncovering antecedents for the development of math-science expertise. *Perspectives on Psychological Science*, *1*, 316–345. doi:10.1111/j.1745-6916.2006.00019.x

Lunney, G. H. (1970). Using analysis of variance with a dichotomous dependent variable: An empirical study. *Journal of Educational Measurement*, *7*, 263–269. doi:10.1111/j.1745-3984.1970.tb00727.x

Maechler et al. (2012). sfsmisc: Utilities for Seminar fuer Statistik ETH Zürich [R package version 1.0-23]. Retrieved from http://cran.r-project.org/web/packages/sfsmisc/index.html

Maydeu-Olivares, A., Coffman, D. L., & Hartmann, W. M. (2007). Asymptotically distribution-free (ADF) interval estimation of coefficient alpha. *Psychological Methods*, *12*, 157–176. doi:10.1037/1082-989X.12.2.157

McCrae, R. R. (1996). Social consequences of experiential openness. *Psychological Bulletin*, *120*, 323–337. doi:10.1037/0033-2909.120.3.323

McCrae, R. R., & Costa, P. T. (1989). Reinterpreting the Myers-Briggs Type Indicator from the perspective of the Five-Factor model of personality. *Journal of Personality*, *57*, 17–40. doi:10.1111/j.1467-6494.1989.tb00759.x

McCrae, R. R. & Costa, P. T. (1997). Personality trait structure as a human universal. *American Psychologist, 52,* 509–516. doi:10.1037/0003-066X.52.5.509

McKee-Ryan, F., Song, Z., Wanberg, C. R., & Kinicki, A. J. (2005). Psychological and physical well-being during unemployment: A meta-analytic study. *Journal of Applied Psychology*, *90*, 53–76. doi:10.1037/0021-9010.90.1.53

Meade, A. W. (2004). Psychometric problems and issues involved with creating and using ipsative measures for selection. *Journal of Occupational and Organizational Psychology*, *77*, 531–551. doi:10.1348/0963179042596504

Mosier, M. F., & Kuder, G. F. (1949). Personal preference differences among occupational groups. *Journal of Applied Psychology*, *33*, 231–239. doi:10.1037/h0059607

Mount, M. K., Barrick, M. R., Scullen, S. M., & Rounds, J. (2005). Higher-order dimensions of the big five personality traits and the big six vocational interest types. *Personnel Psychology*, *58*, 447–478. doi:10.1111/j.1744-6570.2005.00468.x

Mount, M. K., & Muchinsky, P. M. (1978). Person-environment congruence and employee job satisfaction: A test of Holland's theory. *Journal of Vocational Behavior*, *13*, 84–100. doi:10.1016/0001-8791(78)90074-X

Murphy, G. C., & Athanasou, J. A. (1999). The effect of unemployment on mental health. *Journal of Occupational and Organizational Psychology*, *72*, 83–99. doi:10.1348/096317999166518

Murphy, K. R., & Davidshofer, C. O. (2005). *Psychological testing: Principles and applications* (6th ed.). Upper Saddle River, New Jersey: Pearson Prentice Hall.

Nafziger, D. H., Holland, J. L., & Gottfredson, G. D. (1975). Student–college congruency as a predictor of satisfaction. *Journal of Counseling Psychology*, *22*, 132–139. doi:10.1037/h0076340

Nordhausen, K., Oja, H., & Tyler, D. E. (2012). ICS: Tools for Exploring Multivariate Data via ICS/ICA [R package version 1.2-3]. Retrieved from http://cran.r-project.org/web/packages/ICS/index.html

Nordvik, H. (1991a). Kjønnsforskjeller i yrkesønsker. Hvor store er de og hvor fort endres de? *Tidsskrift for Norsk Psykologisk Forening* , *28*, 981–988.

Nordvik, H. (1991b). Work activity and career goals in Holland's and Schein's theories of vocational personalities and career anchors. *Journal of Vocational Behavior*, *38*, 165–178. doi:10.1016/0001-8791(91)90024-G

Nunnally, J. C. (1978). *Psychometric theory* (3rd ed.). New York: McGraw-Hill.

Pervin, L. A. (1968). Performance and satisfaction as a function of individual-environment fit. *Psychological Bulletin*, *69*, 56–68. doi:10.1037/h0025271

Prediger, D. J. (1982). Dimensions underlying Holland's hexagon: Missing link between interests and occupations? *Journal of Vocational Behavior*, *21*, 259–287. doi:10.1016/0001-8791(82)90036-7

Prediger, D. J. (1996). Alternative dimensions for the Tracey–Rounds interest sphere. *Journal of Vocational Behavior*, *48*, 59–67. doi:10.1006/jvbe.1996.0005

Prediger, D. J., & Vansickle, T. R. (1992). Locating occupations on Holland's hexagon: Beyond RIASEC. *Journal of Vocational Behavior*, *40*, 111–128. doi:10.1016/0001-8791(92)90060-D

R Development Core Team (2011). The R project for statistical computing [Software version 2.14.0]. Retrieved from http://www.r-project.org/index.html

Raiche, G., & Magis, D. (2011). nFactors: Parellel Analysis and Non Graphical Solutions to the Cattell Scree Test [R package version 2.3.3]. Retrieved from http://cran.r-project.org/web/packages/nFactors/index.html

Ramberg, I. (2006). *Realfag eller ikke? Elevers motivasjon for valg og bortvalg av realfag i videregående opplæring* (NIFU STEP Report No. 43). Retrieved from http://www.nifu.no/files/2013/05/NIFUSTEPArbeidsnotat2006-43.pdf

Raubenheimer, J. (2004). An item selection procedure to maximize scale reliability and validity. *SA Journal of Industrial Psychology*, *30*, 59–64. doi:10.4102/sajip.v30i4.168

Reas, D., Bang, L., Øverås, M., Lask, B., & Rø, Ø. (2012). Oversettelse og kulturell tilpasning av psykrometriske instrumenter: Erfaringer fra tester som benyttes ved spiseforstyrrelser. *Tidsskrift for Norsk Psykologforening, 49*, 260–264. Retrieved from http://www.psykologtidsskriftet.no/?seks_id=216438&a=2

Reeve, J. (1993). The face of interest. *Motivation and Emotion*, *17*, 353–375. doi:10.1007/BF00992325

Revelle, W. (2013). psych: Procedures for Psychological, Psychometric, and Personality Research [R package version 1.3.2]. Retrieved from http://cran.r-project.org/web/packages/psych/index.html

Ridgon, E. (1997, June 11). Not positive definite matrices-causes and cures. Retrieved from http://www2.gsu.edu/~mkteer/npdmatri.html

Robertson, K. F., Smeets, S., Lubinski, D., & Benbow, C. P. (2010). Beyond the threshold hypothesis even among the gifted and top math/science graduate students, cognitive abilities, vocational interests, and lifestyle preferences matter for career choice, performance, and persistence. *Current Directions in Psychological Science*, *19*, 346–351. doi:10.1177/0963721410391442

Rounds, J. B., & Zevon, M. A. (1983). Multidimensional scaling research in vocational psychology. *Applied Psychological Measurement*, *7*, 491–510. doi:10.1177/014662168300700407

Savickas, M. L. (1999). The psychology of interests. In M. L. Savickas & A. R. Spokane (Eds.), *Vocational interests: Meaning, measurement, and counseling use* (pp. 19–56). Palo Alto, CA: Davies-Black Publishing.

Savickas, M. L., & Spokane, A. R. (Eds.). (1999). *Vocational interests: Meaning, measurement, and counseling use*. Palo Alto, CA: Davies-Black Publishing.

Savickas, M. L., Taber, B. J., & Spokane, A. R. (2002). Convergent and discriminant validity of five interest inventories. *Journal of Vocational Behavior*, *61*, 139–184. doi:10.1006/jvbe.2002.1878

Schaefer, J., Opgen-Rhein, R., Zuber, V., Ahdesmäki, M., Silva, A. P. D., & Strimmer, K. (2012). corpcor: Efficient Estimation of Covariance and (Partial) Correlation [R package version 1.6.4].
Retrieved from http://cran.r-project.org/web/packages/corpcor/index.html

Schermer, J. A., & Vernon, P. A. (2008). A behavior genetic analysis of vocational interests using a modified version of the Jackson Vocational Interest Survey. *Personality and Individual Differences*, *45*, 103–109. doi:10.1016/j.paid.2008.03.009

Schneider, B. (1987). The people make the place. *Personnel Psychology*, *40*, 437–453. doi:10.1111/j.1744-6570.1987.tb00609.x

Schraw, G., & Lehman, S. (2001). Situational interest: A review of the literature and directions for future research. *Educational Psychology Review*, *13*(1), 23–52. doi:10.1023/A:1009004801455

Schreiner, C. (2006). Exploring a ROSE garden: Norwegian youth's orientations towards science – seen as signs of late modern identities (Doctoral dissertation). Retrieved from https://www.duo.uio.no/handle/10852/32331

Schreiner, C. (2008). *Noen realist som passer for meg? Ungdoms valg av utdanning og yrke* (Research Report No. 1). Retrieved from Naturfagsenteret – Nasjonalt senter for naturfag i opplæringen website: http://www.naturfagsenteret.no/binfil/download.php?did=6472

Sedikides, C., & Strube, M. J. (1997). Self-evaluation: To thine own self be good, to thine own self be sure, to thine own self be true, and to thine own self be better. *Advances in Experimental Social Psychology*, *29*, 209–269. doi:10.1016/S0065-2601(08)60018-0

Silvia, P. J. (2005a). Emotional responses to art: From collation and arousal to cognition and emotion. *Review of General Psychology*, *9*, 342–357 doi:10.1037/1089-2680.9.4.342

Silvia, P. J. (2005b). What is interesting? Exploring the appraisal structure of interest. *Emotion*, *5*, 89–102. doi:10.1037/1528-3542.5.1.89

Silvia, P. J. (2006). *Exploring the psychology of interest*. Oxford: Oxford University Press.

Silvia, P. J., & Gendolla, G. H. (2001). On introspection and self-perception: Does self-focused attention enable accurate self-knowledge? *Review of General Psychology*, *5*, 241–269. doi:10.1037/1089-2680.5.3.241

Smart, J. C. (1987). Student satisfaction with graduate education. *Journal of College Student Personnel*, *28*, 218–222. Abstract retrieved from http://psycnet.apa.org/psycinfo/1988-24833-001

Solberg, O. (2008). *Norsk yrkesfinner: Et verktøy for systematisk søk som harmonerer med ditt interessemønster* (7th ed.). Discover Test Service AS.

Spokane, A. R., & Decker, A. R. (1999). Expressed and measured interests. In M. L. Savickas & A. R. Spokane (Eds.), *Vocational interests: Meaning, measurement, and counseling use* (pp. 211–233). Palo Alto, CA: Davies-Black Publishing.

Stevens, J. (2002). *Applied multivariate statistics for social sciences* (4th ed.). Mahwah, NJ : Erlbaum.

Strong, E. K. (1955). *Vocational interests 18 years after college*. Minneapolis: University of Minnesota Press.

Su, R., Rounds, J., & Armstrong, P. I. (2009). Men and things, women and people: A meta-analysis of sex differences in interests. *Psychological Bulletin*, *135*, 859–884. doi:10.1037/a0017364

Super, D. E. (1949). *Apprising vocational fitness by means of psychological tests*. Retrieved from https://archive.org/details/appraisingvocati00insupe

Svendsrud, A. (2009). Interesseteorier og bruk av interesseverktøy: Hollands teori om yrkespersonlighet. *Rådgivernytt*, *4*. Retrieved from http://3zp8n6470ads3gqlg084ocqw5d.wpengine.netdna-cdn.com/wp-content/uploads/sites/2/2014/01/Svendsrud_ARGN_4_2009-1.pdf

Svendsrud, A. (2010). Interesseverktøy i Norge. *Rådgivernytt*, *1*. Retrieved from http://3zp8n6470ads3gqlg084ocqw5d.wpengine.netdna-cdn.com/wp-content/uploads/sites/2/2014/01/Svendsrud_Artikkel_ARGN_1_2010.pdf

Swanson, J. L., & Schneider, M. (2013). Minnesota Theory of Work Adjustment. In S. D. Brown & R. W. Lent (Eds.), *Career development and counseling: Putting theory and research to work* (2nd ed., pp. 29–53). Retrieved from http://site.ebrary.com/lib/ntnu/docDetail.action?docID=10641844

Tak, J. (2004). Structure of vocational interests for Korean college students. *Journal of Career Assessment*, *12*, 298–311. doi:10.1177/1069072703261555

Tenopyr, M. L. (1988). Artifactual reliability of forced-choice scales. *Journal of Applied Psychology*, *73*, 749–751. doi:10.1037/0021-9010.73.4.749

Thorndike, E. L. (1915). The permanence of interests and their relation to abilities. In M. Bloomfield (Ed.), *Readings in vocational guidance* (pp. 386–395). Retrieved from https://archive.org/stream/readingsinvocati00bloo#page/n0/mode/2up

Tinsley, H. E. (2000). The congruence myth: An analysis of the efficacy of the person–environment fit model. *Journal of Vocational Behavior*, *56*, 147–179. doi:10.1006/jvbe.1999.1727

Tinsley, H. E. A. (2001). Marginalization of vocational psychology. *Journal of Vocational Behavior*, *59*, 243–251. doi:10.1006/jvbe.2001.1830

Tracey, T. J., & Rounds, J. B. (1993). Evaluating Holland's and Gati's vocational-interest models: A structural meta-analysis. *Psychological Bulletin*, *113*, 229–246. doi:10.1037/0033-2909.113.2.229

Tracey, T. J., & Rounds, J. (1995). The arbitrary nature of Holland's RIASEC types: A concentric-circles structure. *Journal of Counseling Psychology*, *42*, 431–439. doi:10.1037/0022-0167.42.4.431

Tracey, T. J., & Rounds, J. (1996). The spherical representation of vocational interests. *Journal of Vocational Behavior*, *48*, 3–41. doi:10.1006/jvbe.1996.0002

Tracey, T. J. G., Watanabe, N., & Schneider, P. L. (1997). Structural invariance of vocational interests across Japanese and American cultures. *Journal of Counseling Psychology*, *44*, 346–354. doi:10.1037/0022-0167.44.4.346

Tranberg, M., Slane, S., & Ekeberg, S. E. (1993). The relation between interest congruence and satisfaction: A metaanalysis. *Journal of Vocational Behavior*, *42*, 253–264. doi:10.1006/jvbe.1993.1018

Uebersax, J. (2011, April). Introduction to the tetrachoric and polychoric correlation coefficients [Web article]. Retrieved from http://www.john-uebersax.com/stat/tetra.htm

Ulleberg, P., & Nordvik. H. (2000). *Innføring i faktorteori og eksplorerende faktoranalyse*. Compendium in PSY3100 Research Methodology - Quantitative, Department of Psychology, Norwegian University of Science and Technology, Trondheim, Norway.

Van Iddekinge, C. H., Putka, D. J., & Campbell, J. P. (2011).Reconsidering vocational interests for personnel selection: The validity of an interest-based selection test in relation to job knowledge, job performance, and continuance intentions. *Journal of Applied Psychology*, *96*, 13–33. doi:10.1037/a0021193

Walsh, W. B. (1999). What we know and need to know. In M. L. Savickas & A. R. Spokane (Eds.), *Vocational interests: Meaning, measurement, and counseling use* (pp. 371–382). Palo Alto, CA: Davies-Black Publishing.

Wanberg, C. R. (2012). The individual experience of unemployment. *Annual Review of Psychology*, *63*, 369–396. doi:10.1146/annurev-psych-120710-100500

Wilcox, R. R. (2012). *Introduction to robust estimation and hypothesis testing* (3rd ed.). Retrieved from http://proquestcombo.safaribooksonline.com/9780123869838

World Health Organization. (2011). *Process of translation and adaptation of instruments*. Retrieved from http://www.who.int/substance_abuse/research_tools/translation/en/

Wothke, W. (1993). Nonpositive definite matrices in structural modeling. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 256–293). Newbury Park, CA: Sage Publications.

Zumbo, B. D., Gadermann, A. M., & Zeisser, C. (2007). Ordinal versions of coefficients alpha and theta for Likert rating scales. *Journal of Modern Applied Statistical Methods*, *6*(1), 21–29. Retrieved from http://digitalcommons.wayne.edu/jmasm/vol6/iss1/4

Østbø, L. E., & Nordvik, H. (2008). Personlighetsinventoriet NEO PI-R: Klinisk validitet. *Tidsskrift for Norsk Psykologforening*, *45*, 845–848. Hentet fra http://www.psykologtidsskriftet.no/index.php?seks_id=64853&a=2

## Appendix A

**The Informed consent form (in Norwegian)**

**Informasjon om prosjektet**

Dette spørreskjemaet er en norsk versjon av yrkesinteressetesten Jackson Vocational Interest Survey. Testen brukes for å få økt forståelse om en persons interesser og preferanser for å jobbe i et bestemt yrke og et bestemt arbeidsmiljø.

Formålet med prosjektet er å validere den nylig oversatte norske versjonen av testen.
Det vil ta deg ca. 45 minutter å gjennomføre undersøkelsen. Selve testen består av 289 par setninger (A eller B) som beskriver ulike jobbrelaterte aktiviteter. Du velger det utsagnet (A eller B) som svarer best til dine yrkesinteresser eller -preferanser. Det er ingen «riktige» eller «gale» svar. **Foreta valget kun ut fra dine interesser og preferanser. Se bort fra om du har nødvendige ferdigheter til å utføre disse aktivitetene.** Selv om noen utsagn kanskje ikke beskriver dine preferanser nøyaktig, er det viktig for kvaliteten på undersøkelsen at du gjør et valg for hvert setningspar.

Resultatene fra denne spørreundersøkelsen vil bli benyttet i min masteroppgave i arbeids- og organisasjonspsykologi ved Psykologisk Institutt, NTNU. De vil også kunne bli brukt i vitenskapelige artikler.

**Personvern**

Det er frivillig å delta, og all informasjon vil bli behandlet konfidensielt. Resultatene fra undersøkelsen vil bli presentert slik at ingen enkeltpersoner kan gjenkjennes.

Du samtykker i å delta i undersøkelsen ved å svare på spørsmålene og sende inn svarene ved å klikke på «Ferdig» på siste side. Når du har sendt inn svarene dine, er det ikke lenger mulig å trekke seg fra undersøkelsen. Datamaterialet vil bli anonymisert fullstendig ved prosjektslutt, senest ved utgangen av mai 2014. Det amerikanske firmaet som eier testen SIGMA Assessment Systems Inc. vil få tilgang til anonymiserte data. Prosjektet er meldt til Personvernombudet for forskning, Norsk samfunnsvitenskapelige datatjeneste (NSD AS).

Dersom du har spørsmål om undersøkelsen, er det bare å ta kontakt med meg eller min veileder.

**PREMIETREKNING!**

Hvis du deltar i denne undersøkelsen, og svarer på *alle* spørsmålene, har du mulighet til å bli med i trekningen av **fem midtbysjekker â 500 kr**. Du får mer informasjon om dette når du har svart på spørsmålene.

Vennligst besvar alle spørsmålene i én økt. Bryter du av underveis, vil du ikke kunne komme tilbake til dine svar.

Hvis du har svart på dette spørreskjemaet tidligere, kan du ignorere denne henvendelsen. Det er ikke meningen at noen skal svare to ganger!

På forhånd takk for at du er villig til å delta!

Vennlig hilsen

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## Appendix B

Table B1

*The 32 Original JVIS Basic Interest Scale Descriptions*

| Basic Interest Scale | Description |
|---|---|
| *Accountability* | Preference for work environments requiring a high degree of integrity and traditional values. |
| Adventure | Enjoying experiencing novel situations; seeking out the unusual and dangerous. |
| Creative Arts | Interest in arranging material in an aesthetically pleasing manner; preferring activities requiring creativity and originality in the applied or fine arts. |
| *Dominant Leadership* | Preference for a forceful style of leadership and a strong position of authority requiring close supervision and criticism of the work of others. |
| Engineering | Interest in designing, testing or producing things by applying scientific principles to various practical problems. |
| Family Activity | Taking pleasure in domestic activities, or taking active part in family life and child care. |
| *Job Security* | Preference for well-defined work with predictable future that does not requires taking social and economic risks in the workplace. |
| Life Science | Interest in studying and exploring various aspects of the world of the living organisms. |
| Mathematics | Enjoying operating with mathematical formulas and quantitative concepts, especially so as to find solutions to different problems. |
| Medical Service | Interest in promoting health, treating and curing the sick |
| Nature–Agriculture | Interest in working outdoors with animals or plants. |

(continued)

Table B1

*The 32 Original JVIS Basic Interest Scale Descriptions (continued)*

| Basic Interest Scale | Description |
|---|---|
| Performing Arts | Enjoying performing in front of an audience. |
| Personal Service | Interest in rendering service to clients, for example as a tourist guide or a beautician. |
| Physical Science | Preference for the systematic investigation of various aspects of the non-living nature, often in a laboratory (e.g. chemistry, geology, physics). |
| Skilled Trades | Enjoying manual work or working with machines in order to produce or repair things. |
| Social Science | Interest in studying and exploring different aspects of the organizations of the society, human behaviour, and social interaction. |
| *Stamina* | Willingness to work at a challenging task for long hours without rest; perseverance, commitment and obstinacy in the face of difficulty |
| *Academic Achievement* | Preference for academic work environment, as well as scholarly activities, particularly of a verbal nature (e.g. holding a presentation); also a liking studying. |
| Author–Journalism | Enjoying writing for a general audience in a creative and original manner. |
| Business | Interest in how business and commercial organizations function on a day-to-day basis. |
| Elementary Education | Taking pleasure in teaching and caring for young children. |
| Finance | Interest in meeting the financial needs of the public or of the organization, by solving their financial problems, or helping with investment and trade. |
| Human Relations Management | Enjoying the role of the mediator in conflict situations, including those that are difficult or emotionally charged. |

(continued)

Table B1

*The 32 Original JVIS Basic Interest Scale Descriptions (continued)*

| Basic Interest Scale | Description |
|---|---|
| *Independence* | Preference for a work environment free from restraints (such as e.g. strict rules and regulations) and close supervision, requiring a high degree of independence in problem solving. |
| *Interpersonal Confidence* | Preference for a work environment requiring a high level of self-confidence in interacting with others. |
| Law | Interest in law and legal matters. |
| Office Work | Preference for clerical work and activities that require attention to detail, usually in a business context. |
| *Planfulness* | Preference for a work environment where activities occur in a foreseeable sequence; also being organized and systematic in work habits. |
| Professional Advising | Taking pleasure in counseling and giving expert advice on different topics. |
| Sales | Enjoying influencing people, especially to buy products. |
| Social Service | Interests in helping people face their problems. |
| Supervision | Interest in having managerial responsibilities, such as planning, coordinating and supervising the activities of others. |
| Teaching | Preference for teaching school or university subject matters. |
| Technical Writing | Pleasure of writing detailed, factual reports about scientific, technical, legal, or historical matters. |

*Note.* The work style scales are marked in italics. The first part of the table represents 17 scales that constitute the A-pole of the American version of the JVIS, while the second part of the table refers to 17 scales that constitute the B-pole of the interest inventory. Adopted from *Jackson Vocational Interest Survey manual* (2nd ed.) by D. N. Jackson, 2000, p. 32. 

Table B2

*The Ten General Occupational Themes Descriptions*

| General Occupational Theme | Description | Scales representing the theme |
|---|---|---|
| Assertive | A high score is indicative of a desire to work in environments, where a high level of self-confidence and independence is required, such as directing and controlling others. People salient on this factor tend to be forceful in applying leadership to get job done. They are not reluctant to call attention to themselves or to meet strangers. | *Independence*<br>*Dominant Leadership*<br>*Interpersonal Confidence* |
| Communicative | A high score reflects interest in the formal expression of ideas, especially in a written form. Intellectual understanding and accomplishment, as well as preference for environments where one is exposed to and can communicate various concepts (e.g. being a writer or an academic) is also a central part of this theme. | Technical Writing<br>Author–Journalism<br>*Academic Achievement* |
| Conventional | A high score reflects conventional interests valued in the field of business or commerce. People high on this factor also enjoy orderly environments, often in large organizations, which are characterized by concrete tasks and a high degree of routine or detail. | Office Work<br>Sales<br>Business<br>Supervision |
| Enterprising | A high score indicates preference for activities requiring a high level of self-confidence, and involving day-to-day interaction with people in a context where persuasive motives predominate. People salient on this factor are interested in influencing others by modifying their thinking and decision making in a particular direction. | Professional Advising<br>Human Relations Mng.<br>Finance<br>Law<br>Supervision<br>Business<br>Sales<br>*Interpersonal Confidence* |

(continued)

Table B2

*The Ten General Occupational Themes Descriptions (continued)*

| General Occupational Theme | Description | Scales representing the theme |
|---|---|---|
| Expressive | A high score expresses a preference for the use of aesthetically pleasing and abstract symbols for communication, most often in order to impress or entertain others (e.g. on the stage, in music, visual arts, or in writing). | Performing Arts<br>Creative Arts<br>Author–Journalism |
| Helping | A high score reflects interest in activities involving teaching and social service. People scoring high on this factor enjoy situations in which they can display an instructional, nurturing, or advisory role by helping others, both adults and children, acquire new knowledge, or cope with their problems. | Elementary Education<br>Social Service<br>Teaching |
| Inquiring | A high score is indicative of intellectual curiosity, especially about social organizations, people, and biological organisms. It can reflects interest in pursuing a scientific career, but more often it is a manifestation of interests encompassing activities involving exploring and learning about social and biological environment. | Social Science<br>Life Science<br>Medical Service |
| Logical | A high score reflects a preference for activities requiring logical and abstract thinking, problem solving, and deductive reasoning. People high on this factor value challenging intellectual tasks that presuppose technical precision, quantitative methods and excellence, but not necessarily a high degree of interpersonal confidence. | Mathematics<br>Physical Science<br>Engineering |

(continued)

Table B2

*The Ten General Occupational Themes Descriptions (continued)*

| General Occupational Theme | Description | Scales representing the theme |
|---|---|---|
| Practical | A high score highlights interest in practical activities related to the outdoors, family, physical or mechanic abilities, or direct service to others. Such people are often satisfied in occupations in which they can stay close to their environments and families, and where they do not need to deal with complex social problems. . | Nature–Agriculture<br>Family Activity<br>Creative Arts<br>Skilled Trades<br>Personal Service |
| Socialized | A cluster of work styles reflecting several desirable personal qualities required in a reliable, loyal, responsible, organized, and cautious worker. People scoring high on this factor prefer well-ordered and well-defined environments in which their responsibilities are clear and predictable, and in which they are not expected to take much risk. | *Accountability*<br>*Job Security*<br>*Stamina*<br>*Planfulness* |

*Note.* The work style scales are marked in italics. Adopted from *Jackson Vocational Interest Survey manual* (2nd ed.) by D. N. Jackson, 2000, p. 70–73.

## Appendix C

Table C1

*Pattern Matrix for Exploratory Principal Component Analysis with Oblique Rotation of Study Satisfaction Scales*

| | Rotated component loadings | |
|---|---|---|
| Item | Social Satisfaction | Academic Satisfaction |
| Det sosiale miljøet på min studieretning er godt | **.90** | .01 |
| Jeg synes mine medstudenter er hyggelige og lette å omgås | **.84** | .04 |
| Jeg er stort sett fornøyd med den sosiale delen av min studietilværelse | **.84** | .05 |
| Jeg møter mange interessante mennesker på mitt studium | **.83** | .04 |
| Takket være sosiale aktiviteter på mitt studium blir jeg kjent med nye mennesker | **.80** | –.07 |
| Jeg er tilfreds med sosiale tilbud og arrangementer for studenter | **.74** | –.03 |
| Jeg er entusiastisk over det faglige innholdet i den studieretningen jeg har valgt | –.11 | **.90** |
| Jeg er stort sett fornøyd med den akademiske delen av min 1studietilværelse | .01 | **.86** |
| For det meste finner jeg glede i mitt studiearbeid | .09 | **.85** |
| Jeg liker nivået av intellektuell stimulering i mine fag | .00 | **.81** |
| Jeg er fornøyd med mitt valg av studieretning | .03 | **.77** |
| Jeg er tilfreds med hvor mye jeg lærer i mine fag | .00 | **.77** |
| Eigenvalues | 5.36 | 2.93 |
| % of variance | 44.63 | 24.40 |
| $\alpha_{ordinal}$ | .91 | .91 |

*Note.* Correlation of rotated components $r_{C1C2} = .28$. Component loadings > .40 are in boldface. Academic satisfaction scale was translated and reproduced with permission of Professor Robert W. Lent.

Table C2

*Summary of Intercorrelations, Means, and Standard Deviation for Scores on the 17 Scales of the Translated JVIS, and the Student Satisfaction Scales*

| Scale | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Mathematical Reasoning | – | | | | | | | | | |
| 2. Performing Arts | −.06 [−.14, .03] | – | | | | | | | | |
| 3. Writing | −.32** [−.39, −.24] | .35** [.27, .43] | – | | | | | | | |
| 4. Medical Service | .27** [.19, .35] | .05 [−.04, .13] | −.22** [−.31, −.14] | – | | | | | | |
| 5. Adventure | .17** [.08, .26] | .29** [.20, .37] | −.05 [−.13, .04] | .27** [.19, .34] | – | | | | | |
| 6. *Interpersonal Confidence* | −.12** [−.22, −.02] | −.04 [−.13, .05] | .11* [.02, .19] | −.08 [−.16, .01] | −.19** [−.28, −10] | – | | | | |
| 7. Natural Science | .63** [.57, .68] | .04 [−.05, .13] | −.23** [-.31, −.16] | .41** [.32, .49] | .31** [.23, .39] | −.18** [−.26, −.08] | – | | | |
| 8. Professional Advising | .07 [−.02, .17] | −.16** [−.23, −.08] | .13** [.05, .21] | −.13** [−.22, −.03] | −.03 [−.12, .07] | .06 [−.02, .16] | −.03 [−.12, .05] | – | | |
| 9. Teaching | −.19** [−.27, −.10] | .04 [−.05, .13] | .17** [.08, .25] | −.06 [−.16, .04] | −.12** [−.21, −.04] | .18** [.08, .27] | −.22** [−.31, −.12] | .05 [−.04, .13] | – | |
| 10. *Accountability–Independence* | .01 [−.08, .09] | −.01 [−.10, .07] | −.11* [−.20, −.01] | .07 [−.02, .16] | .04 [−.05, .12] | .10* [.01, .21] | .07 [−.02, .16] | −.15** [−.23, −.06] | .00 [−.09, .09] | – |

(continued)

Table C2

*Summary of Intercorrelations, Means, and Standard Deviation for Scores on the 17 Scales of the Translated JVIS, and the Student Satisfaction Scales (continued)*

| Scale | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 11. *Stamina* | .30** [.22, .37] | –.18** [–.27, –.09] | –.32** [–.40, –.24] | .17** [.09, .25] | .05 [–.04, .13] | –.03 [–.12, .07] | .17** [.07, .27] | .03 [–.05, .11] | –.14** [–.23, –.06] | .13** [.03, .22] |
| 12. Social Science | .04 [–.05, .13] | .13** [.04, .21] | .18** [.10, .26] | .13** [.04, .22] | .24** [.16, .32] | –.05 [–.14, .05] | .32** [.24, .41] | .01 [–.09, .11] | .05 [–.03, .14] | .04 [–.07, .14] |
| 13. *Dominant Leadership* | –.00 [–.10, .09] | –.00 [–.10, .10] | .02 [–.07, .11] | .14** [.05, .23] | .14** [.05, .23] | .01 [–.08, .11] | .02 [–.07, .10] | .14** [.05, .23] | –.07 [–.15, .01] | –.08 [–.17, .03] |
| 14. Social Service | –.37** [–.44, –.29] | –.04 [–.13, .06] | .16** [.08, .25] | .13** [.04, .24] | –.10* [–.18, –.02] | .16** [.07, .24] | –.23** [–.31, –.14] | .01 [–.08, .10] | .45** [.38, .53] | .03 [–.07, .11] |
| 15. Creative Arts | .20** [.11, .29] | .36** [.28, .43] | –.01 [–.11, .08] | .12** [.03, .21] | .17** [.09, .27] | –.12** [–.21, –.02] | .30** [.21, .38] | –.32** [–.39, –.24] | –12** [–.23, –.01] | .04 [–.04, .13] |
| 16. Practical Activities–Conventional Activities | .11* [.02, .19] | .23** [.14, .32] | –.12** [–.21, –.03] | .25** [.16, .33] | .36** [.28, .44] | –.22** [–.31, –.13] | .37** [.29, .45] | –.26** [–.35, –.18] | –.12** [–.21, –03] | ,09* [–.00, .19] |
| 17. *Job Security* | .09 [–.01, .17] | –.05 [–.14, .05] | –.17** [–.26, –.07] | .10* [.02, .19] | –.08 [–.18, .02] | –.01 [–.11, .09] | .09 [–.02, .18] | –.30** [–.38, –.22] | –.06 [–.15, .04] | .12* [.02, .22] |
| Academic Satisfaction | .06 [–.04, .16] | –.09 [–.17, .00] | .00 [–.09, .10] | .07 [–.02, .15] | –.04 [–.14, .04] | .12* [.03, .21] | .09* [.01, .18] | .09 [.01, .18] | .09 [.00, .17] | .12** [.03, .22] |
| Social Satisfaction | –.01 [–.09, .10] | –.08 [–.17, .02] | –.06 [–.16, .03] | .03 [–.06, .11] | .04 [–.06, .13] | .03 [–.06, .12] | .03 [–.05, .11] | .09 [–.01, .18] | .14** [.03, .24] | .01 [–.07, .09] |
| *M* | 12.00 | 5.28 | 7.32 | 8.20 | 8.45 | 4.16 | 12.99 | 2.33 | 5.93 | 3.34 |
| *SD* | 6.69 | 3.48 | 4.10 | 4.62 | 3.88 | 1.08 | 6.58 | 1.57 | 2.23 | .96 |

(continued)

Table C2

*Summary of Intercorrelations, Means, and Standard Deviation for Scores on the 17 Scales of the Translated JVIS, and the Student Satisfaction Scales (continued)*

| Scale | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Academic Satisfaction | Social Satisfaction |
|---|---|---|---|---|---|---|---|---|---|
| 11. *Stamina* | – | | | | | | | | |
| 12. Social Science | –.12** [–.21, –.03] | – | | | | | | | |
| 13. *Dominant Leadership* | .12** [.03, .21] | –.08 [–.18, .01] | – | | | | | | |
| 14. Social Service | –.18** [–.26, –.09] | .20** [.10, .29] | –.08 [–.16, .01] | – | | | | | |
| 15. Creative Arts | –.03 [–.11, .05] | .17** [.09, .24] | –.22** [–.31, –.13] | –.10* [–.20, –.01] | – | | | | |
| 16. *Practical Activities–Conventional Activities* | –.00 [–.08, .08] | .28** [.20, .36] | –.07 [–.16, .03] | –.02 [–.11, .08] | .53** [.46, .59] | – | | | |
| 17. *Job Security* | .16** [.06, .25] | –.02 [–.11, .07] | –.09* [–.19, .00] | –.12** [–.21, –.03] | .13** [.04, .23] | .17** [.08, .26] | – | | |
| Academic Satisfaction | .16** [.06, .25] | .16** [.07, .24] | .01 [–.09, .11] | .06 [–.05, .15] | .00 [–.09, .10] | .05 [–.04, .14] | –.02 [–.10, .07] | – | |
| Social Satisfaction | .02 [–.07, .11] | –.09 [–.17, .00] | .09 [–.01, .18] | .07 [–.03, .15] | –.13** [–.22, –.04] | –.03 [–.13, .06] | –.05 [–.15, .05] | .29** [.19, .38] | – |
| *M* | 5.92 | 5.89 | 5.29 | 5.97 | 6.63 | 6.65 | 7.37 | 23.32 | 23.31 |
| *SD* | 2.21 | 2.37 | 2.62 | 3.16 | 3.99 | 3.44 | 3.03 | 4.25 | 4.83 |

*Note*. $N = 483$; *$p < .05$, two-tailed; ** $p < .01$, two-tailed; *Note*. 95% Confidence Intervals are reported in brackets. The work style scales are marked in italics.

Table C3

*Minimum Values, Maximum Values, Means and Standard Deviations for the JVIS Scores, Academic Satisfaction Scores, and Social Satisfaction Scores for the Six Student Groups*

| | Social Science ($n$ = 126) | | | Medical Science ($n$ = 38) | | | The Humanities ($n$ = 84) | | | Natural Science and Mathematics ($n$ = 75) | | | Engineering and Technology ($n$ = 101) | | | Teacher Education ($n$ = 60) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scale | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) |
| Mathematical Reasoning | 0 | 24 | 7.70 (5.25) | 1 | 23 | 13.16 (5.76) | 0 | 22 | 8.46 (5.75) | 4 | 24 | 15.48 (6.05) | 5 | 24 | 16.95 (4.77) | 0 | 24 | 12.57 (6.33) |
| Performing Arts | 0 | 14 | 5.24 (3.70) | 1 | 13 | 5.32 (3.17) | 0 | 14 | 7.17 (3.50) | 0 | 12 | 5.39 (3.48) | 0 | 12 | 3.96 (2.65) | 0 | 12 | 4.78 (3.32) |
| Writing | 1 | 15 | 8.40 (3.49) | 0 | 15 | 7.05 (3.59) | 2 | 15 | 10.55 (3.51) | 0 | 14 | 5.67 (3.68) | 0 | 15 | 5.10 (3.64) | 0 | 15 | 6.50 (4.13) |
| Medical Service | 0 | 16 | 7.53 (4.22) | 2 | 17 | 14.05 (3.43) | 0 | 16 | 6.10 (3.82) | 1 | 17 | 9.89 (4.49) | 0 | 17 | 7.51 (4.27) | 1 | 15 | 7.90 (4.32) |
| Adventure | 0 | 16 | 7.90 (4.05) | 0 | 15 | 8.50 (3.67) | 0 | 16 | 8.25 (3.86) | 1 | 16 | 9.03 (3.81) | 0 | 16 | 8.92 (4.03) | 0 | 15 | 8.32 (3.46) |
| *Interpersonal Confidence* | 2 | 5 | 4.52 (.72) | 1 | 5 | 4.32 (.96) | 1 | 5 | 4.19 (1.07) | 1 | 5 | 3.81 (1.33) | 1 | 5 | 3.88 (1.15) | 0 | 5 | 4.15 (1.05) |
| Natural Science | 0 | 22 | 9.32 (5.44) | 3 | 26 | 13.16 (5.83) | 0 | 22 | 10.26 (6.00) | 3 | 26 | 18.81 (5.48) | 3 | 26 | 15.37 (5.09) | 0 | 24 | 13.12 (6.81) |

(continued)

Table C3

*Minimum Values, Maximum Values, Means and Standard Deviations for the JVIS Scores, Academic Satisfaction Scores, and Social Satisfaction Scores for the Six Student Groups (continued)*

| | Social Science ($n$ = 126) | | | Medical Science ($n$ = 38) | | | The Humanities ($n$ = 84) | | | Natural Science and Mathematics ($n$ = 75) | | | Engineering and Technology ($n$ = 101) | | | Teacher Education ($n$ = 60) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scale | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) |
| Professional Advising | 0 | 5 | 2.41 (1.54) | 0 | 5 | 2.26 (1.61) | 0 | 5 | 2.27 (1.62) | 0 | 5 | 1.79 (1.47) | 0 | 5 | 2.72 (1.45) | 0 | 5 | 2.30 (1.73) |
| Teaching | 2 | 10 | 6.44 (1.94) | 2 | 10 | 6.16 (1.81) | 0 | 10 | 5.68 (2.34) | 0 | 10 | 5.20 (2.46) | 1 | 10 | 5.09 (2.06) | 3 | 10 | 7.38 (1.81) |
| *Accountability–Independence* | 0 | 4 | 3.29 (.96) | 1 | 4 | 3.50 (.83) | 0 | 4 | 3.24 (.94) | 0 | 4 | 3.44 (1.03) | 0 | 4 | 3.25 (1.03) | 0 | 4 | 3.50 (.83) |
| *Stamina* | 0 | 9 | 5.02 (2.01) | 3 | 9 | 6.87 (1.61) | 0 | 9 | 5.51 (2.15) | 0 | 9 | 6.57 (2.34) | 1 | 9 | 6.68 (2.02) | 0 | 9 | 5.65 (2.27) |
| Social Science | 0 | 10 | 6.51 (2.43) | 0 | 9 | 4.89 (2.41) | 0 | 10 | 5.94 (2.43) | 1 | 10 | 6.43 (2.13) | 1 | 10 | 5.05 (2.36) | 1 | 10 | 5.87 (1.87) |
| *Dominant Leadership* | 0 | 12 | 4.91 (2.42) | 1 | 12 | 6.24 (2.97) | 0 | 11 | 5.12 (2.70) | 1 | 11 | 5.36 (2,46) | 0 | 11 | 5.47 (2.75) | 0 | 11 | 5.33 (2.58) |
| Social Service | 1 | 11 | 7.75 (2.73) | 2 | 11 | 7.32 (2.55) | 0 | 11 | 6.10 (3.08) | 0 | 11 | 4.53 (2.84) | 0 | 11 | 3.79 (2.74) | 0 | 11 | 6.67 (2.52) |

(continued)

Table C3

*Minimum Values, Maximum Values, Means and Standard Deviations for the JVIS Scores, Academic Satisfaction Scores, and Social Satisfaction Scores for the Six Student Groups (continued)*

| | Social Science ($n$ = 126) | | | Medical Science ($n$ = 38) | | | The Humanities ($n$ = 84) | | | Natural Science and Mathematics ($n$ = 75) | | | Engineering and Technology ($n$ = 101) | | | Teacher Education ($n$ = 60) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scale | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) | *Min* | *Max* | *M* (*SD*) |
| Creative Arts | 0 | 16 | 5.94 (3.65) | 0 | 15 | 5.63 (4.42) | 0 | 16 | 7.42 (3.93) | 0 | 15 | 8.25 (4.10) | 0 | 16 | 5.96 (4.00) | 0 | 15 | 6.70 (3.60) |
| Practical Activities–Conventional Activities | 0 | 14 | 5.79 (3.02) | 0 | 13 | 6.29 (3.03) | 0 | 13 | 6.76 (3.62) | 1 | 14 | 8.24 (3.46) | 0 | 14 | 5.69 (3.70) | 2 | 12 | 8.13 (2.59) |
| *Job Security* | 0 | 12 | 6.73 (3.01) | 2 | 13 | 7.71 (2.92) | 0 | 13 | 6.83 (3.26) | 0 | 13 | 7.89 (3.22) | 1 | 13 | 7.55 (2.69) | 3 | 13 | 8.30 (2.77) |
| Academic Satisfaction | 6 | 30 | 23.32 (4.57) | 12 | 30 | 25.00 (3.80) | 5 | 30 | 23.31 (4.73) | 8 | 30 | 23.53 (3.97) | 7 | 30 | 22.56 (4.22) | 12 | 30 | 23.02 (3.72) |
| Social Satisfaction | 6 | 30 | 22.85 (4.67) | 17 | 30 | 24.37 (3.44) | 8 | 30 | 22.08 (4.88) | 8 | 30 | 22.85 (5.34) | 8 | 30 | 24.37 (5.07) | 14 | 30 | 24.12 (4.35) |

*Note*. The work style scales are marked in italics

Table C4

*Number of women and men in the six student groups*

| Student group | Women | Men |
|---|---|---|
| Social Science | 101 | 25 |
| Medical Science | 29 | 9 |
| The Humanities | 62 | 22 |
| Natural Science and Mathematics | 49 | 26 |
| Engineering and Technology | 48 | 52 |
| Teacher Education | 47 | 13 |
| Total | 336 | 147 |

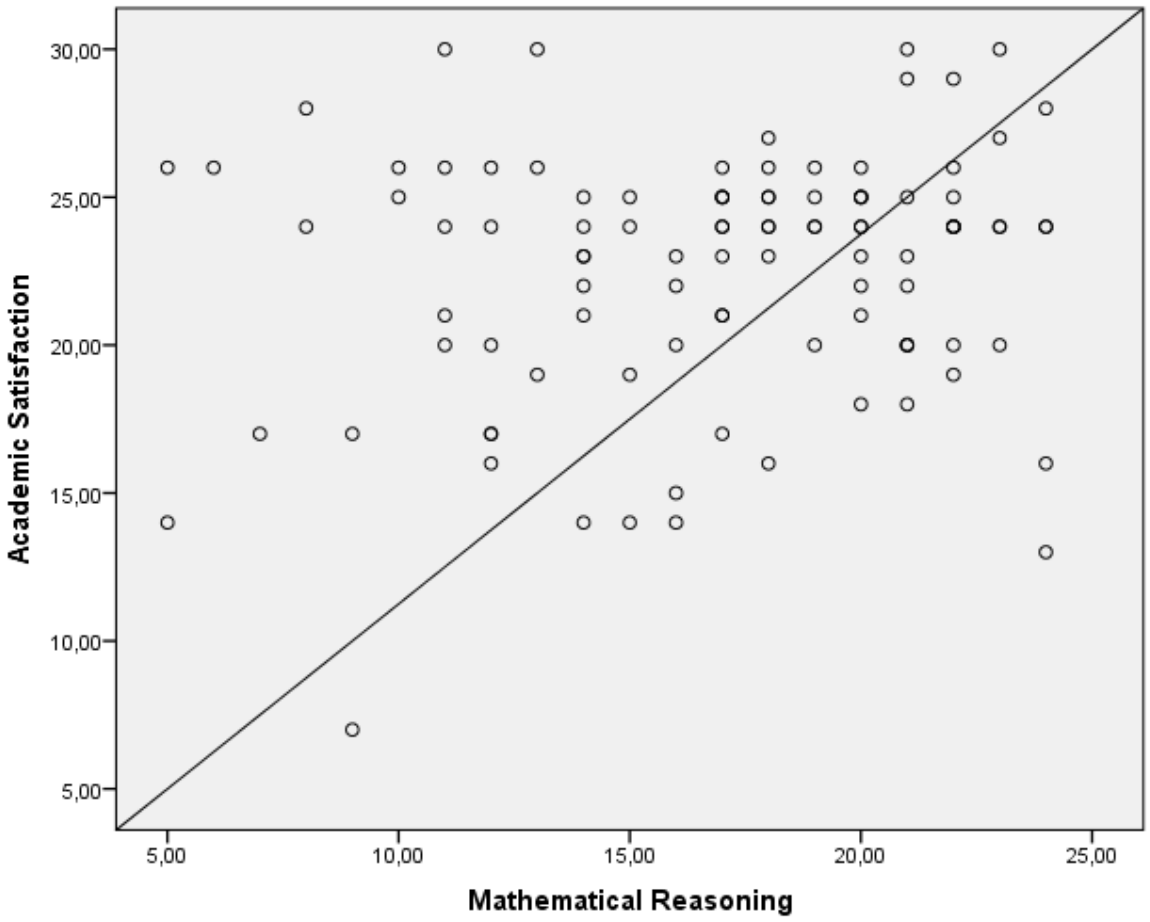


*Figure C.* Scatterplot showing the linear relationship between scores on the Academic Satisfaction scale and the Mathematical Reasoning scale in the sample of engineering and technology students