

Assessment of Social Competence for Pilot Selection - A Combined Analysis of Self-report and Behavior-oriented Approaches

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In order to ensure that pilots possess the necessary skills for effective teamwork during line operation, airlines have introduced various diagnostic methods into their selection procedures that are designed to assess the social competence of pilot applicants prior to employment. A validation study with N=292 *ab-initio pilots* for a major European airline is described, in which assessment center (AC) methods have been compared with questionnaires on social competence and personality. Results show moderate to high correlations between two social competence questionnaires and certain personality dimensions, while only one social competence questionnaire (the Social Skills Inventory, SSI) confirms systematic common variance with the behavior-oriented assessments of related concepts in the AC. In addition to traditional selection procedures, the SSI could neither improve the prediction of applicants' overall performance in pilot selection nor did it show substantial intercorrelations with an external criterion in the pilot training.

Therefore, social competence and personality questionnaires could serve as an additional

component in the pre-selection, but may not replace the AC, which provides information about the behavioral component of social competence in real social interactions.

Focusing on competencies instead of traditional intelligence and aptitude tests in selection is an approach that was first introduced by McClelland (1973) based on the assumption that testing job-relevant competence would be more valid for predicting job performance. Definitions of competencies often include knowledge, skills, abilities, or personality characteristics, and they focus on outcomes and consequently also on behavior (e.g., Heinsman, de Hoogh, Koopman, & van Muijen, 2007; Morgeson, Delaney-Klinger, Mayfield, Ferrara, & Campion, 2004; Shipmann, et al., 2000; Sparrow & Bognanno, 1993). Hence, competencies are heterogeneous and not equivalent to “traditional” personality traits and basic cognitive abilities. In contrast rather context-independent cognitive dispositions, competencies are described as context-specific (Koeppen, Hartig, Klieme, & Leutner, 2008).

As a broad construct, social competence has been addressed from different angles in various fields of psychology. Definitions include social competence as a dynamic construct involving the ability to adjust to and interact in given social conditions (Argyle, 1994; Tajfel, 1981), social competence as people’s belief in their efficacy (Bandura, 1997), and social competence in terms of social intelligence (Gardner, 1999) or even emotional intelligence (Goleman, 1995).

Social competencies comprise interactions between individual characteristics, social demands, and situational characteristics. They have to be understood within the specific context, since very different social behaviors may be required and valued depending on the context (Argyle, Henderson, & Furnham, 1985). A common classification describes social competence as being composed of two different aspects. The *cognitive component* is necessary for analyzing

and understanding social situations and interpersonal relations. Based on this classification, the *behavioral component* involves behavioral patterns for appropriately managing social situations and effectively influencing the responses of others (Thorndike, 1920; Ferris, Witt, & Hochwarter, 2001). There is a general consensus that social competence is both required in and based on social interactions, and furthermore, that social competence is a multidimensional construct (Marlowe, 1986).

SOCIAL COMPETENCE IN AVIATION

It is commonly accepted in the aviation industry that crewmembers in multi-pilot line operations should be competent in communication, cooperation, and leadership. According to IATA (2012) and other sources, at least a subset of social competencies is required during a pilot's career (Goeters, Maschke & Eissfeldt, 2004). Analyses of accidents and incidents (Helmreich, Merritt, & Wilhelm, 1999) as well as safety investigations within airlines (Burger, Neb, & Hoermann, 2002, 2003) have shown many instances where operational safety was compromised by a lack of assertiveness, authoritative behavior, poor decision making, or a lack of situational awareness among flight crewmembers. In a safety survey with over 2000 pilots from Lufthansa German Airlines, it was found that social factors in the cockpit play a greater role in the frequency, risk, and mastery of safety-related incidents, than either human error or operational/technical issues (Kemmler & Neb, 2001). However, the appropriate amount of these "non-technical" skills is neither assured by an air-transport pilot license nor is it acquired "on the fly" with increasing flight time or rank. Therefore, in the 1990s, regulators began to mandate that airlines and training organizations systematically train pilots and cabin crewmembers in subjects

such as Crew Resource Management (CRM), Multi-Crew Cooperation, and Human Performance and Limitations (e.g., ICAO, 1998; European Commission, 2008, 2011; EASA, 2009).

Nevertheless, it is still debatable whether these training courses involve sufficient intensity to build up the necessary competency level within just a few days.

Empirical studies of training efficiency have shown that training of interpersonal skills in regular CRM courses is not equally effective for all pilots due to various reasons (Helmreich & Wilhelm, 1991; Helmreich et al., 1999). Helmreich and Wilhelm (1991) pinpoint personality factors as a possible explanation for the fact that some pilots showed even lower social attitudes after CRM training. After a decade of research, Helmreich and his team suggested shifting the focus of CRM towards threat and error management (TEM) to achieve a higher degree of universality for the CRM concept, especially across cultures (Helmreich et al., 1999). In recent meta-studies carried out by Salas and his team, the statistical impact of CRM training on the attitudes and behaviors of the participating crew members remained vague (Salas, Burke, Bowers, & Wilson, 2001; Salas, Wilson, Burke, & Wightman, 2006; O'Connor, Campbell, Newon, Melton, Salas, & Wilson, 2008). O'Connor et al.'s review identified medium to large effects for CRM training on participants' behaviors and attitudes. However, only the increment of social attitudes was statistically significant. Furthermore, with respect to the prolonged effects of training, other research showed that the attitude improvements gained from CRM training faded over time (Helmreich & Taggart, 1995). These findings are not meant to generate skepticism about the merits of the CRM concept in general. There are no doubts that CRM has positively influenced the aviation industry for more than 30 years and has become an integral part of the professional culture of pilots (Helmreich, 2006). On the individual level, however, it cannot be

assumed that present CRM training programs alone can sufficiently compensate for some pilots' lack of social competence.

Even though there is considerable evidence for the importance of social competence of pilots, pilot selection systems primarily place emphasis on tests of cognitive abilities, knowledge, psychomotor skills, and experience (Hunter & Burke, 1994; Martinussen, 1996; Martinussen & Torjussen 1998). A possible reason is that selection tests have mainly been validated against technical performance criteria during ab-initio pilot training in both military and civil aviation. In this context, cognitive tests have repeatedly demonstrated predictive validity and have been suitable methods for reducing dropout rates during training. This approach works well until later stages in the pilot's career, when basic flying skills have been fully mastered and inter-individual differences in non-technical skills become more relevant for safe and efficient flight operation. However, systematic analyses of the job requirements for experienced pilots are rare, thus making personality traits or social competence less likely to be identified as an integral part of the pilot's job profile (Damos, 1996, 2003).

In summary, there are several important reasons to include measures of social competence in addition to cognitive tests in pilot selection procedures, especially when the aim is to predict career development beyond the completion of ab-initio pilot training. However, suitable methods need to be customized to the airline's specific needs, and the additional resources that would be required for test administration, including expert personnel, have to be taken into consideration. Therefore, the aim of this study was to compare different approaches to measuring social competence during pilot selection, and also to evaluate the impact of these approaches on the selection decision as well as further external criteria.

SOCIAL COMPETENCE: MEASUREMENT

Traditionally, there are three different approaches to measuring relevant “soft skills” in the context of personnel selection: interviews, questionnaires based on personality traits, and behavior-oriented assessment centers. Questionnaire-based social competence measurements could be a useful and very cost-effective way to measure social competence during an early stage in the selection process.

Interviews are a widespread method for assessing social skills within social situations (Huffcutt, Conway, Roth, & Stone, 2001). Various meta-analyses have shown that selection interviews have reasonable criterion validity and predict job performance ratings as well as training success (e.g., Huffcutt & Arthur, 1994; Marchese & Muchinsky, 1993; McDaniel, Whetzel, Schmidt, & Maurer, 1994; Schmidt & Hunter, 1998; Schmidt & Rader, 1999). Comparatively little research has been done on the construct validity of interviews (Huffcutt et al., 2001; Salgado & Moscoso, 2002). This may be due to the fact that job interviews often measure a wide variety of constructs (Bobko, Roth, & Potosky, 1999; Campion, Palmer, Campion, 1997; Hunter & Hunter, 1984) which makes it difficult to identify the individual constructs assessed by an interview (Schmidt & Radar, 1999). Nevertheless, meta-analyses found a moderate to high positive correlation between different types of interviews (structured vs. unstructured and conventional vs. behavioral) and social skills (Huffcutt et al., 2001; Salgado & Moscoso, 2002).

As candidates tend to present themselves in the best possible way employment interviews may evoke faking, which could be interpreted as a threat to the validity of an interview (Levashina & Campion, 2006). In a study with undergraduate job candidates Levashina and

Campion (2007) could show that faking behavior is used by a majority of applicants and that faking behavior is dependent on the type of questions.

Finally, interviews are still very popular and can be conducted with comparably little time and effort. But efficiency depends on the number of candidates. If various candidates have to be interviewed, interviews may be inefficient as applicants can be interviewed only one by one whereas other instruments allow simultaneously testing of several candidates.

Personality questionnaires are another method used for assessing social skills or social competence. An advantage of personality questionnaires is that they are very efficient by allowing testing a large group of applicants within a short time. Several studies have been able to show positive relationships between self-report measures of personality and of social competence (e.g., Kanning, 2006; Riggio, 1986). Furthermore, in a meta-analysis on the construct validity of assessment centers, Collins, Schmidt, Sanchez-Ku, Thomas, McDaniel and Le (2003) found a positive relation between personality questionnaires and behavior-oriented assessment centers. Nonetheless, although personality traits and social competence are related (Schneider, Ackerman, & Kanfer, 1996), personality is not equivalent to social competence (Riggio, 1986). While personality traits cover a wide range of habitual patterns of behavior, thought, and emotion and are relatively stable over time, social competencies focus on interactions between individuals and depend on situational characteristics. Therefore, personality trait based questionnaires do not seem to be an appropriate method for assessing social competence. Furthermore, personality questionnaires do have the widely known disadvantage of being susceptible to social desirable or faked answers (Viswesveran & Ones, 1999).

Assessment Centers. Assessment centers (AC) are a method that is very commonly used in personnel selection for measuring social competence (Spsychalski, Quinones, Gaugler, & Pholey,

1997), though they may have a wide range of validity, depending on the quality of the AC (Thornton & Rupp, 2005). In contrast to interviews and personality questionnaires, ACs provide information on the behavioral component of social competence in real social interactions.

According to the Guidelines and Ethical Considerations for Assessment Center Operations put forth by the International Task Force on Assessment Center Guidelines (2009), ACs should include several job-related simulations to provide multiple opportunities to observe and assess job-relevant behavior. Ideally, an AC is integrated into a larger selection procedure that includes multiple techniques, such as psychometric tests, work samples, and interviews (Krause & Gebert, 2003). Assessment centers are frequently used in many different sectors (e.g., government, banking and insurance, electronics and energy, manufacturing) throughout the United States (Spychalski et al., 1997) and German-speaking countries (Krause & Gebert, 2003).

Criterion validity of ACs could be shown in several studies and meta-analysis (e.g. Arthur, Day, & Evens, 2003; Gaugler, Rosenthal, Thornton, & Bentson, 1987), whereas evidence for the construct validity seems to be lacking (e.g. Sackett & Dreher, 1982; Schneider & Schmitt, 1992; Woehr & Arthur, 2003). In a review of ACs' construct validity Howard (1997) concludes that several studies found observer ratings to correlate higher with different dimensions within one exercise than with observer ratings of the same dimension across exercises. Therefore, it is very important for the practical application of an AC to include exercises, which represent key situations for successful job performance. Like self-report measures in the context of personnel selection, ACs may face the problem of social desirability or faking. This problem is closely connected to the concept of transparency of the target dimensions (Kleinmann, 1993). Especially in transparent situations, where the observed dimensions are announced to the participants, the applicants are more likely to show their maximum performance instead of their typical

performance (Smith-Jentsch, 2007). Maximum performance describes what an individual "can do" and is provoked in assessment situations where the subject is aware of being evaluated, instructed to maximize effort, and when the measurement period is short enough to allow focused attention (Sackett, Zedeck, & Fogli, 1988). In contrast, the typical performance describes what an individual "will do" on the job. A non-transparent AC is supposed to evoke more of a typical performance from the candidates and therefore it is more likely to assess behavioral dimensions validly and predict job performance better (Smith-Jentsch, 2007). Furthermore, in an elaborated overview of the topic of transparency and the ability to identify criteria, Kleinmann, Ingold, Lievens, Jansen, Melchers, and König (2011) conclude that making dimensions transparent reduces criterion-related validity.

In recent years, ACs have become an important component of the whole selection process for pilots within European and Asian-Pacific airlines (Damitz, Manzey, Kleinmann, & Severin, 2003; Bartram & Baxter, 1996) and have shown adequate psychometric properties in several studies (Damitz et al. 2003; Hoefl & Pecena, 2004). The assessment center (VerDi) of the German Aerospace Center (DLR) was developed in 1994 (Hoermann, Manzey, Maschke, & Pecena, 1997). It is entirely behavior-oriented and therefore only consists of behavior-oriented exercises, in contrast to the widespread practice of using an assortment of different methods in ACs. Nevertheless, VerDi is part of a comprehensive selection process and thus diverse methods are used in other stages of the DLR pilot selection procedure. In a pre-selection stage for pilot applicants basic abilities (e.g., spatial orientation and memory capacity), basic knowledge (e.g., basic physical and technical principles) as well as specific psychomotor and multiple-task capacities are assessed. VerDi is implemented in the second selection stage, followed by a work sample (fixed-base flight simulator) and an interview. These assessment techniques

(psychometric tests, behavioral exercises, work samples, and interviews) all provide independent selection information that cannot be obtained by one of the others (Hoeft & Pecena, 2004).

Following the interview, a selection panel reviews all available information for each candidate and then concludes in the final recommendation of pass or fail. Further details about the DLR selection procedure are described below in the methods section and can also be found the literature (e.g. Goeters, 2004).

To summarize, ACs provide behavior-based information on social competence and may be a valuable addition to traditional selection procedures, but they also face problems like a low inter-rater reliability and a lack of construct validity (see e.g., Sackett & Dreher, 1982). Furthermore, compared to other methods of assessing social competence, this method is more complex and expensive and therefore less economic (Thornton & Rupp, 2005).

Social competence questionnaires. Similar to ACs self-description questionnaires measure different facets of social competence. In comparison to ACs, questionnaires provide a less situation-specific assessment of social competence. While ACs are based on actually shown behaviors, questionnaire items may include intended behaviors in hypothetical situations as well.

Two approaches can be distinguished which are commonly used to define components of social competence in questionnaires (Buhrmester, Furman, Wittenberg, and Reis, 1988): a) components which correspond to types of interpersonal task domains (e.g. initiating social interactions, refusing unreasonable demands) and b) components reflecting social skills that determine effective social interaction (e.g. social expressivity, social sensitivity). Social competence questionnaires do have the advantage of being very economical, but on the other hand, as with other questionnaires in selection contexts, they only solicit self-descriptions and thus involve the risk of attaining only socially desirable answers. Unlike personality and attitude

questionnaires, they are not commonly used for personnel selection and cannot be subsumed in meta-analyses of typical predictors for pilot performance in selection procedures (Hunter & Burke, 1995; Martinussen, 1996; Martinussen & Hunter, 2010). Nevertheless, Jansen, Melchers, and Kleinmann (2012) were able to show that a self-report measurement of social competence in personnel selection added incremental validity beyond both the assessment center and interview performance, thus contributing to the predictive validity of their selection procedure.

RESEARCH OBJECTIVE

This study investigates whether social competence questionnaires can be used as a low-cost alternative to ACs in pilot selection or serve as a pre-selection tool for more expensive methods at a later stage (AC and interview). Two social-competence questionnaires are compared within this context. They represent the two approaches described by Buhrmester et al.: a) the Interpersonal Competence Questionnaire (ICQ, Buhrmester et al., 1988) and b) the Social Skills Inventory (SSI, Riggio, 1989). Both questionnaires had been used in studies of personnel selection and demonstrated construct validity by confirmatory factor analysis (Kanning, 2006; Riggio, 1989) and by profile comparison among various occupational groups (Riggio, 1989). The ICQ is based on a classification of interpersonal tasks that determine the quality of social relations (approach a) as described above). These interpersonal tasks were derived from literature surveys and validated by exploratory and confirmatory factor analyses, as well as in correlation studies with the NEO-PI and related measures of social functioning (Buhrmester et al., 1988; Kanning 2006). Riggio's SSI frames social skills by a set of verbal and nonverbal communication skills, denoted as social and emotional in his model (Riggio, 1989; Riggio & Reichard, 2008).

The key skills in both of these communication forms correspond to sending, decoding, and regulating interpersonal interactions. Riggio deems all six SSI-skills as prerequisites for effective leadership in general (approach b) as described above). However, it can be expected that the job profile of airline pilots particularly requires verbal communication skills, in contrast to the emotional skills.

METHOD

Sample and Procedure

$N=305$ applicants for ab-initio pilot training at Lufthansa's Flight Training Center in Germany were included in this study. The mean age was of 22 years ($SD=2$ years). Most of the participants (86%) were male. All applicants had completed a high school education adequate for university entrance. 46 subjects had some flying experience on gliders or single engine airplanes (up to roughly 50 hours). During the selection process no credit was given to applicants with previous flight time.

A multistage selection procedure was applied with five stages in total: (1) basic pilot aptitude tests, (2) psychomotor tests, (3) an assessment center (VerDi), (4) a fixed-base simulator, and (5) an interview. The average statistical pass rates for each stage during the time of this study were 35.7% (basic aptitudes), 87.2% (psychomotor tests), 64.9% (AC), 77.1% (simulator), and 73.2% (interview), which totals to an overall selection ratio of 11.4 %. All candidates in this sample had passed the first selection stage and $N=263$ also passed the second stage. In the end, $N=88$ out of 305 candidates were recommended for pilot training. With the exception of four candidates (4.5% failure rate) all subjects who were recommended successfully completed their flight

training for the *Frozen Air-Transport Pilot License* (ATPL) and were hired as first officers by the airline. In order to address potential bias in the self-assessment methods, the 13 subjects with the highest scores on a social desirability scale (1.5 *SD* above mean) were excluded from the analyses. The final *N* is therefore 292 subjects.

For this study two social competence questionnaires were administered to all applicants at stage 2.

Measures

Interpersonal Competence Questionnaire (ICQ). A German version of the ICQ was used which had been validated in several studies by Kanning (e.g., Kanning, 2006). Like the original ICQ (Buhrmester, Furman, Wittenberg & Reiss, 1988), the German version has 40 behavior-related items distributed across five scales: (1) Initiation of Interactions and Relationships (IIR; 8 items, e.g., 'Finding and suggesting things to do with new people whom you find interesting and attractive.'; $\alpha = .81$); (2) Assertion of Personal Interests (API; 8 items, e.g., 'Standing up for your rights when a companion is neglecting you or being inconsiderate.'; $\alpha = .74$); (3) Self-disclosure of Personal Information (SDC; 8 items, e.g., 'Letting down your protective "outer shell" and trusting a close companion.'; $\alpha = .67$); (4) Emotional Support of Others (ESO; 8 items, e.g., 'Being able to say and do things to support a close companion when s/he is feeling down.'; $\alpha = .81$); (5) Management of Interpersonal Conflicts (MIC; 8 items, e.g., 'Refraining from saying things that might cause a disagreement to build into a big fight.'; $\alpha = .69$).

Social Skills Inventory (SSI). The original SSI by Riggio (1989) was translated into German by Radke (2001). It consists of 90 behavior-related items distributed equally across six different scales: (1) Emotional Expressivity (EEP; 15 items, e.g., 'It is difficult for others to know, when I

am sad or depressed (reversed score)'; $\alpha = .63$); (2) Emotional Sensitivity (ESE; 15 items, e.g., 'I am often told that I am a sensitive, understanding person. '; $\alpha = .75$); (3) Emotional Control (ECT; 15 items, e.g., 'While I may be nervous on the inside, I can disguise it very well from others. '; $\alpha = .69$); (4) Social Expressivity (SEP; 15 items, e.g., 'I love to socialize. '; $\alpha = .85$); (5) Social Sensitivity (SSE; 15 items, e.g., 'I am very sensitive of criticism. '; $\alpha = .73$); (6) Social Control (SCT; 15 items, e.g., 'I am usually very good at leading group discussions. '; $\alpha = .76$).

Both the ICQ and the SSI were administered together with 4-point rating scales, as opposed to the 5-point scales in the original. The intention of using 4-point scales was to eliminate the neutral middle category, which some subjects might use to avoid disclosing too much personal information.

Temperament Structure Scales (TSS). The TSS (Maschke, 1987), a non-clinical personality questionnaire developed by DLR in the 1970s, is a regular part of the selection procedure. It contains 183 items, which are presented in four different formats: agree/disagree items referring to behavior intentions (e.g., 'Do you sometimes talk about things you do not understand?'), yes/no items referring to actual past behaviors (e.g., 'I participated in sports more than others'), perceived peer-ratings (e.g., 'How do your friends judge or see you? Please, decide for each question which word is more applicable: quiet vs. talkative'), and choices of suitable personal statements (e.g., 'Please, choose one of the following statements: I often devote my attention to other people's affairs vs. I stay out of such affairs'). All items and item formats are distributed among ten dimensions: (1) Extraversion (EXT, $\alpha = .67$), (2) Dominance (DOM, $\alpha = .82$), (3) Emotional Warmth (WAR, $\alpha = .63$), (4) Emotional Instability (EIN, $\alpha = .79$), (5) Aggressiveness (AGG, $\alpha = .61$), (6) Vitality (VIT, $\alpha = .85$), (7) Achievement Motivation (AMO, $\alpha = .61$), (8) Rigidity (RIG, $\alpha = .74$), (9) Mobility (MOB, $\alpha = .84$), and (10) Openness (OPN, $\alpha = .83$) as a

control scale. Cronbach's Alpha ranges from $\alpha=.61$ to $\alpha=.85$ with a mean of $\alpha=.75$ according to data from a study with $N=300$ pilot applicants by Goeters, Timmermann, & Maschke (1993). According to Goeters et al. (1993), the TSS scales can be distinguished between work-related traits (AMO, RIG, MOB, VIT), aspects of social behavior (EXT, DOM, AGG), and factors of stress-resistance/emotionality (EIN, WAR). Especially for the "social" TSS-scales, correlations with social competencies can be expected.

Assessment Center (AC). The AC consisted of four different exercises, each reflecting different aspects of goal-oriented social behavior relevant for pilots: two small-group problem-solving tasks, a conflict role-play, and a dyadic cooperation test with two candidates working together on two interconnected computers. It took about one full day for a group of eight to ten candidates to go through all exercises. During these exercises, a team of four trained observers (airline pilots and aviation psychologists) assessed seven behavioral dimensions in all subjects. The seven dimensions can be allocated to two competence areas (Hoeft & Pecena, 2004). Both of these competence areas are conceived as subcomponents of social competence. The first competence area, Interpersonal Competence (ICO, $\alpha=.80$), includes (1) Cooperation (COO, $\alpha=.60$), (2) Conflict Management (CMT, $\alpha=.59$), (3) Empathy (EMP, $\alpha=.70$), and (4) Self-reflection (SRF, $\alpha=.61$). The second competence area, Operational Competence (OCO, $\alpha=.86$), consists of (5) Initiative (INI, $\alpha=.77$), (6) Flexibility (FLX, $\alpha=.63$), and (7) Stress Resistance (STR, $\alpha=.64$). These evaluation dimensions were made transparent to the applicants during a briefing session. An observer rotation plan allowed each candidate to be independently observed by two different assessors in each exercise.

Every new observer attended at least three Assessment Centers as an additional observer before his or her first assignment and took part in a two days lasting training concentrating on

formal aspects of the AC. Due to this preparation, no major differences were found between ratings given by airline pilots and aviation psychologists. Inter-rater agreement on the rating dimensions within each single exercise varies between .34 and .68 regardless of the raters' professions (Hoefl & Pecena, 2004).

Cognitive Abilities (ABI). Four basic aptitude tests were included in the analysis: Mental Rotation (ROT, dice rotations according to oral instructions; $\alpha = .73$), Mental Arithmetic (MAR, visually and acoustically presented calculation problems; $\alpha = .90$), Complex Attention Control (CAC, rapid calculations after symbol-digit substitution; $\alpha = .92$), and Visual Perceptual Speed (PSP, recall of information from sensory memory; $\alpha = .73$). All cognitive ability tests were administered during stage 1 of the selection procedure and were fully computer-based. The test results were transformed to nine-point standard scales (Stanine scales). More details about the cognitive ability tests developed by DLR can be found in Goeters (2004) or Stahlberg and Hoermann (1993).

Simulator (SIM). Using a low-fidelity simulator with basic instruments, the applicants had to fly three different tracks, which were displayed on the cockpit's front panel. Prior to testing, all applicants studied a familiarization booklet for the simulator. In addition they received an oral briefing followed by three practice runs with instructor feedback. The final performance score is based on the instructor ratings on a nine-point scale with a reliability estimate of $\alpha = .60$.

Final Grades (FIN). A first final grade (FIN_1) reflects the applicant's success during the entire selection process and is given to all subjects ($N=292$). This score is binary coded (selection passed: $FIN_1 = 1$; selection failed: $FIN_1 = 0$). Additionally, those who passed the selection procedure received a rating for their expected overall career success (FIN_2) on a nine-point scale ($N=136$). This score was agreed on by the interview panel after completing the final interview. It

integrates all available information (results of the pre-selection phase, including cognitive performance and TSS, AC results, SIM results, and interview impressions) into a clinical judgment. 136 candidates reached the interview phase and received this grade. Both of these grades were used as criteria for determining the incremental validity of the questionnaires in the selection process, compared to the AC exclusively.

Training Success (TRS). Training success is an extended pass/fail criterion. Four out of the 88 recommended student pilots failed the flight training (TRS=0). An additional six pilots needed significant supplementary training to complete the flight training successfully (TRS=1). The other 78 student pilots finished their training successfully without any irregularities (TRS=2). This information was used in the analyses as an external validity criterion.

RESULTS

Initial factor analyses were conducted in order to examine whether the translation of the ICQ and SSI into German affected the original factor structure of the questionnaire items. Using procrustes rotation, a fair match for most of the scales could be confirmed. The overall factor congruence coefficient for the ICQ was .92 and for SSI .93. ICQ Self-disclosure of Personal Information (.83) and SSI Social Expressivity (.84) scored slightly lower. The intercorrelation between the ICQ and SSI total scores as the sum of all items was highly significant, with $r = .54^{**}$.

Intercorrelations between the social competence questionnaire scales and the TSS personality questionnaire provided a reasonable picture of related concepts in both the ICQ and SSI (see tables 1 and 2). All correlation coefficients in tables 1, 2, 3, and 5 were corrected for direct range

restrictions using Barrett's program for correlation attenuation corrections version 2.1 (Barrett, 2002). The uncorrected correlations are shown in the appendix (tables 1a, 2a, 3a, 5a).

Unrestricted sample distribution scores were taken from the normative samples of pilot applicants if available. For the DLR tests, these samples included typical ab-initio applicants at stage 1. As ICQ and SSI were administered to a preselected sample in stage 2 of the selection process, unrestricted distribution scores for these two tests had to be derived from comparable studies of non-pilots in the literature (e.g. Kanning 2006, Riggio, 1989).

Since corrected correlations cannot be tested for statistical significance, coefficients of $r_{\text{corr}} \geq .20$ were regarded as a noteworthy relationship. Social competence, as measured by the two questionnaires, showed moderate convergent validities with personality dimensions like Extraversion, Emotional Instability, Dominance (leadership), Emotional Warmth, and Aggressiveness. The ICQ-scale Initiation of Interactions and Relationships had the highest correlations with Extraversion (.48) and Emotional Instability (-.31). The ICQ scale Management of Interpersonal Conflicts showed the lowest correlations with the TSS (table 1).

< Insert Table 1 here >

The correlations for the SSI-scales with the TSS-scales were higher than between the ICQ-scales and the TSS. As shown in table 2, all SSI-scales had noteworthy correlations with several TSS-scales, except Emotional Control. The two highest correlations were between the SSI-scale Social Expressivity and Extraversion in the TSS (.61) and between the SSI-scale Social Sensitivity and Emotional Instability in the TSS (.58). However, in contrast to the ICQ, not all SSI scales seemed to reflect positive personality aspects. In particular, Social Sensitivity

substantially correlated with Emotional Instability and Aggressiveness, which, according to the DLR selection principles, are deemed unfavorable personality attributes for pilots. Negative correlations between Social Sensitivity and other SSI-scales (e.g. -.69 with Social Control) further tarnished the image of this scale.

< Insert Table 2 here >

The intercorrelations between the questionnaire scales may be overestimated to some degree because of the common method variance of TSS, ICQ, and SSI. Therefore, using correlations across different types of methods was a more critical approach to checking the construct validity of the social competence questionnaires. The AC was based on behavior observations in actual social settings, while the questionnaire scores were all based on self-assessments. Table 3 shows the correlations between the AC dimensions and the questionnaire scales.

< Insert Table 3 here >

The results for the intercorrelations between questionnaire scales and AC dimensions were quite distinct. Whereas the coefficients for the ICQ and TSS were in all low or negative, the SSI confirmed systematic common variance with the behavior-oriented assessments of related concepts in the AC. Several SSI-scales showed a consistent pattern of correlations with the AC. In particular, Emotional Expressivity, Social Expressivity, and Social Control exhibited positive convergent validities with several AC subcomponents of Interpersonal and Operational

Competence, and vice versa. Again, an unexpected negative correlation was found between Social Sensitivity and Initiative (-.21).

In order to gain information about the predictive power of the different measures of social competence during the selection process, the final grades for the whole selection procedure (FIN_1 = pass/fail; FIN_2 = career prognosis) were chosen as intermediate criteria. These grades were used as dependent variables in multiple regression analyses with different sets of predictors, as shown in table 4. Additionally, the AC total scores ICO and OCO were used as criteria in models 1, 2, and 3 in order to further examine whether questionnaires of social competence can be valuable pre-selection tools, thereby reducing costs of more expensive methods in later selection stages. Table 4 illustrates how the different predictor sets in the DLR selection system were interlinked. Four different predictor models were compared: 1) traditional pilot ability tests and the personality questionnaire, 2) questionnaires of social competence, 3) model 1 with the SSI and ICQ in addition, 4) AC total scores with the ICQ, SSI, or TSS in addition.

< Insert Table 4 here >

When the model with traditional selection tests (model 1.3) was compared to the models with the additional questionnaires of social competence (model 3.1 and 3.2), a significant incremental validity could be seen for the AC score of Operational Competence (.31* vs. .39**). Primarily the SSI accounted for this increment. In a forward regression analysis with the four ability tests and the ten TSS scales, the SSI scale Social Expressivity increased the explained criterion variance significantly from 9.5% to 15% (model 3.2). Nevertheless, for the prediction of the final result (FIN_1) and the career prognosis (FIN_2) at the end of the selection process, the social

competence questionnaires only added a negligible amount of explained variance (.40 vs. .43 for FIN_2 in model 4.2 and 4.3). The best prediction was provided by the AC scores in combination with the TSS scales. Only the TSS scales increased the predictive value for the career prognosis in addition to the two AC scores. For FIN_2 , the multiple correlation increased from .40** in model 4.1 to .48** in model 4.4.

The only available external criterion for this study was the success during pilot training (TRS). Training success was an extended pass/fail criterion and therefore primarily related to the results of the technical training tasks of ab-initio flight training. Ten of the 88 student pilots unexpectedly encountered irregularities during their training. Four trainees failed completely, six trainees needed an extra amount of training. Bivariate correlations were calculated between TRS and all predictors, including the ability tests and a simulator test. The results are shown in table 5. For comparison, bivariate correlations with the final selection grade FIN_2 were also included. All correlations were corrected for range restrictions.

< Insert Table 5 here >

According to these findings, the ICQ and SSI did not have a consistent relationship with the criteria. All correlations for the ICQ were negligible. Only higher scores on the SSI-scale Emotional Sensitivity (ESE) correlated with a higher number of training irregularities (i.e. a lower training success rate). This was in line with the negative correlation between TRS and the TSS-scale Emotional Warmth (WAR). Most of the AC dimensions correlated with the final grade (FIN_2) to a larger extent. The final grade seemed to emphasize the value of the interpersonal competencies (ICO) in particular. Cooperation (COO) was the only AC dimension

with a positive correlation to training success. On the other hand, the cognitive and psychomotor performance tests Complex Attention Control (CAC), Perceptual Speed (PSP) and the work sample simulator test (SIM) showed clearly the highest predictive validities for training success as a criterion beyond the selection process.

DISCUSSION

This study examines different approaches to measuring social competence (AC and social competence questionnaires) within the context of traditional pilot selection methods consisting of cognitive ability tests, a personality questionnaire, a work sample test in a simulator, and an interview. The goal is to determine whether fast and easy methods for discerning aspects of social competence, such as questionnaires, can be considered a viable alternative to more expensive, behavior-oriented AC techniques, or whether they could be beneficial pre-selection tools.

The results show significant, moderate to high correlations between the two social competence questionnaires and certain personality dimensions, such as Extraversion, Emotional Stability, Agreeableness, Dominance (leadership), and Emotional Warmth. These personality factors are mainly reflected in the SSI-scales Social Expressivity, Social Sensitivity (-), and Social Control, as well as the ICQ-scales Initiation of Interactions, Assertion of Personal Interests, and Emotional Support. The consistency of this correlation pattern is in line with expectations (e.g. Goeters et al., 1993) and with findings from earlier studies (e.g. Buhrmester et al., 1988; Riggio, 1989, Kanning, 2006). As measured in the two questionnaires, social competence is clearly linked to personality traits reflecting social orientation and emotional

stability. It should be noted that the SSI-scale Social Sensitivity is positively associated with certain personality attributes, like the TSS-scales Emotional Instability and Aggressiveness, which are unfavorable factors in an operational team environment. This is not surprising because in Riggio's (1986, 1989) original validation studies, Social Sensitivity also correlated with social anxiety and neuroticism, characteristics which are certainly not indicative of assertive CRM behavior in the cockpit. Due to this and some negative intercorrelations among the SSI-scales themselves, the total SSI-score described in Riggio's test manual should be used with caution when drawing general conclusions about the social competence of individuals.

An examination of convergent validity coefficients between the questionnaires and assessment center scales yields clear results. Both the ICQ and the TSS seem to be weak predictors of actual social behavior in real situations. Correlations between the AC dimensions and ICQ- and TSS-scales are generally low. On the other hand, some SSI-scales have consistent correlations with behavior observations regarding Conflict Management, Initiative, and Stress Resistance, as observed during the AC exercises. Again, Social and Emotional Expressivity as well as Social Control, as measured using the SSI, are positively related to the AC dimensions. Social Sensitivity once more correlates negatively with AC observations for Initiative. These findings support the assumption that Riggio's concept of social competence as a set of skills of effective social interaction allows for a reasonable prediction of actual social behavior during the AC.

This is confirmed by results from multiple regression analyses. The SSI-scales account for significant incremental validity in the prediction of Operational Competence, a subdomain of social competence consisting of Initiative, Flexibility, and Stress Resistance in the DLR AC. In addition to traditional ability tests and a personality questionnaire, the SSI could therefore serve

as an inexpensive pre-selection filter to raise the pass rate in the less economical assessment center. However, neither the ICQ nor the SSI improves the prediction of the subjects' overall success in the pilot selection. The pass rate is primarily related to the two main AC subcomponents Interpersonal Competence and Operational Competence. This could be due to the fact that neither ICQ nor SSI scores were available to the selection panel, because these tests were not part of the official selection program. Only the TSS personality questionnaire can explain a small amount of additional variance. Therefore, in a situation where comprehensive AC exercises and a personality questionnaire are already administered, the role of social competence questionnaires would be limited to pre-selection tools. They cannot replace the AC.

During this study, the access to long-term validity criteria for career success was very limited. Success data during the first two years of ab-initio pilot training was used. Admittedly, this is not the best criterion to reflect pilots' social competence, because failure during training was primarily caused by a lack of technical competencies, only sometimes mixed with attitude problems. The findings in our study confirm that traditional performance tests clearly explain the largest amount of variance. In particular, the two best predictors are an attention control test and the simulator as a work sample test. Only the AC dimension Cooperation shows noteworthy correlations with training success. Negative predictions were found for the SSI sensitivity scales and the TSS-scale Emotional Warmth. With respect to the AC, earlier research has reported several findings that demonstrate the predictive validity of AC measures for important aspects of job performance: training data as well as peer-ratings in several samples with licensed pilots, ab-initio pilots, and air-traffic controllers (Hoermann et al., 1997; Damitz et al. 2003; Hoeft & Pecena, 2004). Additionally, Pecena (2000) confirmed significantly higher social acceptance of

applicants for the AC, compared to personality questionnaires, by asking applicants to assess the informative value of both methods for selecting pilots.

Referring back to the bimodal concept of social competence, consisting of a cognitive and a behavioral component, by Thorndike (1920) and Ferris et al. (2001), these findings confirm that the behavioral component should be given more weight in diagnostic decisions for selecting pilot applicants. Social situations by nature are highly dynamic and interactive, whereas situational descriptions in questionnaires always remain static and behavioral intentions hypothetical. Hence, social competence can best be derived from observations of real behavior. Based on the results of this study, in general, self-reported questionnaire data cannot be confirmed to have an approximately equivalent predictive value to ACs. This justifies the greater efforts of designing and conducting job-related behavior exercises during selection, and training a group of assessors with professional experience.

In order to save costs, the assessment center should be integrated into a multi-stage selection procedure where weaker candidates can be filtered out by less expensive methods beforehand, e.g., cognitive tests administered by computer or a social competence questionnaire as shown in this study. As self-assessment questionnaires are always threatened by the phenomenon of social desirability, interesting alternatives for pre-selection tools measuring social competence could include situational judgment tests (SJT) or performance-based tests of social competencies. For example, Hedge, Bruskiwicz, Borman, Hanson, and Logan (2000) developed an aviation-specific test which is directly based on the crew resource management concept. Like other SJTs, this test is based on job-specific but scripted situations, not on real social interactions where the behavioral component is required. Alternative examples for performance-based tests of social competence are tests of social intelligence, which focus on the cognitive component of social

competence and include authentic social situations (e.g. Magdeburg Test of Social Intelligence (MTSI); Conzelmann, Weis & Süß, in press).

In conclusion, if social competence is considered an essential requirement (not just “nice to have”) for the profile of an airline pilot and future captain, it should receive more attention in training and selection. Traditional pilot training is still largely technical and procedure-oriented, and to a much lesser extent directed towards systematic development of non-technical skills. By suitable psychometric measures for social competence as part of the selection procedure a higher level of competence in this area can be ensured right from the start. Together with subsequent CRM trainings this could contribute to the long-term success in the pilot’s career.

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Table 1

Means, standard deviations, and correlation matrix of ICQ and TSS

	<i>M</i>	<i>SD</i>	11	12	13	14	15
<i>Temperament Structure Scales</i>							
1 Extraversion	5.74	1.81	.48	.04	.24	.12	.03
2 Dominance	5.04	1.89	.17	.18	.06	.09	-.02
3 Emotional Warmth	4.42	1.65	-.09	-.32	.18	.37	.10
4 Emotional Instability	3.87	1.93	-.31	-.28	-.10	.07	-.08
5 Aggressiveness	3.92	1.69	-.20	-.07	-.14	-.14	-.22
6 Vitality	5.37	1.96	.16	.03	.04	.02	.04
7 Achievement Motivation	3.99	1.40	-.07	-.10	.09	-.03	.04
8 Rigidity	4.17	1.87	.00	-.04	.11	.06	.06
9 Mobility	3.51	1.99	-.13	-.15	-.02	.08	-.02
10 Openness	4.66	2.11	.10	-.12	-.13	-.12	-.21
<i>Interpersonal Competence Questionnaire</i>							
11 Initiation of Interactions and Relationships	3.18	0.42					
12 Assertion of Personal Interests	2.88	0.41	.38				
13 Self-disclosure of Personal Information	2.90	0.39	.45	.32			
14 Emotional Support of Others	3.31	0.40	.24	.11	.45		
15 Management of Interpersonal Conflicts	3.10	0.35	.21	.14	.29	.39	

Notes. $N = 292$. Correlations are corrected for range restriction. Coefficients $\geq .20$ in boldface.

Table 2

Means, standard deviations, and correlation matrix of SSI and TSS

	<i>M</i>	<i>SD</i>	11	12	13	14	15	16
<i>Temperament Structure Scales</i>								
1 Extraversion	5.74	1.81	.38	.22	-.08	.61	-.03	.26
2 Dominance	5.04	1.89	.19	.03	.09	.25	-.20	.21
3 Emotional Warmth	4.42	1.65	-.04	.42	-.02	-.12	.53	-.19
4 Emotional Instability	3.87	1.93	-.14	.08	-.12	-.33	.58	-.42
5 Aggressiveness	3.92	1.69	-.04	.01	-.11	-.15	.22	-.26
6 Vitality	5.37	1.96	.05	.08	.05	.16	-.10	.12
7 Achievement Motivation	3.99	1.40	-.06	.10	-.04	.00	.27	-.07
8 Rigidity	4.17	1.87	-.11	.08	-.01	-.06	.10	-.01
9 Mobility	3.51	1.99	-.09	.12	-.06	-.14	.19	-.14
10 Openness	4.66	2.11	.05	-.06	-.04	-.04	.12	-.16
<i>Social Skills Inventory</i>								
11 Emotional Expressivity	2.48	0.29						
12 Emotional Sensitivity	2.69	0.32	.32					
13 Emotional Control	2.56	0.29	-.43	.14				
14 Social Expressivity	2.85	0.37	.74	.48	-.11			
15 Social Sensitivity	2.45	0.31	-.13	.25	-.25	-.35		
16 Social Control	3.04	0.31	.47	.39	.38	.81	-.69	

Notes. $N = 292$. Correlations are corrected for range restriction. Coefficients $\geq .20$ in boldface.

Table 3

Correlations of AC-dimensions and questionnaire data

	COO	CMT	EMP	SRF	INI	FLX	STR	ICO	OCO
<i>Interpersonal Competence Questionnaire</i>									
Initiation of Interactions and Relationships	-.05	.05	.07	-.12	.19	-.02	.07	-.02	.12
Assertion of Personal Interests	-.09	-.05	-.02	-.06	-.08	-.18	.07	-.07	-.09
Self-disclosure of Personal Information	-.08	-.02	-.07	-.06	.00	-.07	-.04	-.08	-.04
Emotional Support of Others	-.03	.02	-.01	-.07	.01	-.08	.04	-.03	-.02
Management of Interpersonal Conflicts	-.05	.00	-.16	-.18	.10	-.11	-.07	-.13	-.03
<i>Social Skill Inventory</i>									
Emotional Expressivity	.07	.31	.21	.16	.26	.08	.28	.24	.29
Emotional Sensitivity	-.02	.06	-.06	.01	.02	.07	.12	.00	.09
Emotional Control	-.05	-.02	-.24	.04	.11	.02	-.04	-.11	.05
Social Expressivity	.03	.30	.17	.06	.31	.06	.31	.17	.33
Social Sensitivity	.03	-.15	.11	.11	-.21	.08	-.08	.05	-.11
Social Control	-.06	.30	-.06	-.04	.30	-.10	.37	.04	.28
<i>Temperament Structure Scales</i>									
Extraversion	-.08	.06	.09	.01	.10	-.04	-.03	.02	.02
Dominance	.06	.16	.09	.06	.16	.09	.11	.11	.17
Emotional Warmth	-.16	-.04	-.05	.02	.04	.07	-.09	-.07	.01
Emotional Instability	-.08	-.16	-.07	-.06	-.10	.03	-.11	-.11	-.09
Aggressiveness	-.08	-.07	-.05	-.05	-.11	.08	.11	-.08	.02
Vitality	-.06	.07	-.05	-.04	.00	.00	-.05	-.03	-.02
Achievement Motivation	-.04	.03	-.03	.06	-.04	.13	.01	.00	.04
Rigidity	.07	.03	.05	.05	-.03	.18	-.05	.07	.04
Mobility	-.14	-.05	-.18	-.04	.04	.00	-.01	-.14	.02
Openness	.02	.02	-.01	-.02	.04	.05	.08	.00	-.02

Notes. $N = 263$. Correlations are corrected for range restriction. Coefficients $\geq .20$ in boldface.

COO=Cooperation; CMT=Conflict Management; EMP=Empathy; SRF=Self-Reflection; INI=Initiative; FLX=Flexibility; STR=Stress Resistance; ICO=Interpersonal Competence; OCO=Operational Competence.

Table 4

Multiple correlations for the overall selection scores and the AC total scores

Predictor sets	ICO	OCO	FIN ₁	FIN ₂
1. <i>Basic aptitudes and personality</i>				
1.1 TSS scales	.24	.27*	.15	.31*
1.2 Ability tests	.20*	.20*	.22**	.25
1.3 Ability tests plus TSS scales	.29	.31*	.25	.31*
2. <i>Social competence questionnaires</i>				
2.1 ICQ scales	.13	.17	.08	.14
2.2 SSI scales	.16	.24*	.16	.12
2.3 SSI plus ICQ scales	.25	.31**	.18	.21
3. <i>Combination of models 1 and 2</i>				
3.1 Ability tests and TSS plus ICQ scales	.33	.36*	.26	.43
3.2 Ability tests and TSS plus SSI scales	.33	.39**	.30	.41
4. <i>AC plus all questionnaire scales</i>				
4.1 AC total scores ICO and OCO			.48**	.40**
4.2 AC ICO and OCO plus ICQ scales			.50**	.43**
4.3 AC ICO and OCO plus SSI scales			.50**	.42**
4.4 AC ICO and OCO plus TSS scales			.49**	.48**

Notes. $N=263$ for ICO, OCO; $N=136$ for FIN₂;

$N=292$ for FIN₁ (Model 1; $N=263$ for FIN₁ (Model 2-5).

ICO=Interpersonal Competence; OCO=Operational Competence; FIN₁= final grade (passed vs. failed); FIN₂=expected career success.

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

Table 5

Correlation matrix of all predictors with training success (TRS) and the final grade (FIN₂).

	TSS	EXT	DOM	WAR	EIN	AGG	VIT	AMO	RIG	MOB	OPN
<i>Criteria</i>											
FIN ₂		-.06	.07	-.01	-.11	-.09	.01	.28	.17	-.14	.00
TRS		-.13	.00	-.39	-.17	-.05	-.24	.10	.17	-.01	-.05
<i>ICQ</i>											
	IIR	API	SDC	ESO	MIC						
FIN ₂	-.04	.07	.03	-.02	-.08						
TRS	-.08	-.06	-.10	-.05	.16						
<i>SSI</i>											
	EEP	ESE	ECT	SEP	SSE	SCT					
FIN ₂	-.03	-.13	.06	-.05	.03	.02					
TRS	-.07	-.30	.17	-.02	-.18	.12					
<i>AC</i>											
	COO	CMT	EMP	SRF	FLX	INI	STR	ICO	OCO		
FIN ₂	.27	.42	.30	.30	.27	.19	.14	.51	.35		
TRS	.20	.15	-.14	.01	.05	.03	.13	.01	-.01		
<i>ABI</i>											
	ROT	MAR	CAC	PSP	SIM						
FIN ₂	.06	.19	.26	.09	.28						
TRS	.12	.09	.27	.20	.39						

Notes. $N = 136$ (FIN₂) and $N = 88$ (TRS). Correlations are corrected for range restriction. Coefficients $\geq .20$ in boldface.

TSS=Temperament Structure Scales; EXT= Extraversion; DOM= Dominance; WAR= Emotional Warmth; EIN=Emotional Instability; AGG=Aggressiveness; VIT=Vitality; AMO=Achievement Motivation; RIG=Rigidity; MOB=Mobility; OPN=Openness; FIN₂=expected career success; TRS=Training Success; ICQ=Interpersonal Competence Questionnaire; IIR=Initiation of Interaction and Relationship; API=Assertion of Personal Interests; SDC=Self-disclosure of Personal Information; ESO=Emotional Support of Others; MIC=Management of Interpersonal Conflicts; SSI=Social Skill Inventory; EEP=Emotional Expressivity; ESE=Emotional Sensitivity; ECT=Emotional Control; SEP=Social Expressivity; SSE=Social Sensitivity; SCT=Social Control; AC=Assessment Center; COO=Cooperation; CMT=Conflict Management; EMP=Empathy; SRF=Self-Reflection; INI=Initiative; FLX=Flexibility; STR=Stress Resistance; ICO=Interpersonal Competence; OCO=Operational Competence; ABI=Cognitive Abilities; ROT=Mental Rotation; MAR=Mental Arithmetic; CAC=Complex Attention Control; PSP=Visual Perception Speed; SIM=Simulator.

APPENDIX

Table 1a

Means, standard deviations, and uncorrected correlation matrix of ICQ and TSS

	<i>M</i>	<i>SD</i>	11	12	13	14	15
<i>Temperament Structure Scales</i>							
1 Extraversion	5.74	1.81	.44**	.04	.22**	.11	.03
2 Dominance	5.04	1.89	.16**	.17**	.06	.08	-.02
3 Emotional Warmth	4.42	1.65	-.07	-.27**	.15*	.31**	.08
4 Emotional Instability	3.87	1.93	-.30**	-.27**	-.10	.07	-.08
5 Aggressiveness	3.92	1.69	-.17**	-.06	-.12*	-.12	-.19
6 Vitality	5.37	1.96	.16**	.03	.04	.02	.04
7 Achievement Motivation	3.99	1.40	-.05	-.07	.06	-.02	.03
8 Rigidity	4.17	1.87	.00	-.04	.10	.06	.06
9 Mobility	3.51	1.99	-.13	-.15	-.02	.08	-.02
10 Openness	4.66	2.11	-.11*	-.13*	-.14*	-.13*	-.22**
<i>Interpersonal Competence Questionnaire</i>							
11 Initiation of Interactions and Relationships	3.18	0.42					
12 Assertion of Personal Interests	2.88	0.41	.34**				
13 Self-disclosure of Personal Information	2.90	0.39	.42**	.30**			
14 Emotional Support of Others	3.31	0.40	.25**	.12*	.47**		
15 Management of Interpersonal Conflicts	3.10	0.35	.21**	.14*	.29**	.39**	

Notes. $N = 292$.

* $p < .05$; ** $p < .01$ (two-tailed).

Table 2a

Means, standard deviations, and uncorrected correlation matrix of SSI and TSS

	<i>M</i>	<i>SD</i>	11	12	13	14	15	16
<i>Temperament Structure Scales</i>								
1 Extraversion	5.74	1.81	.35**	.20**	-.07	.57**	-.03	.24**
2 Dominance	5.04	1.89	.18**	.03	.08	.24**	-.19**	.20**
3 Emotional Warmth	4.42	1.65	-.03	.36**	-.02	-.10	.40**	-.16**
4 Emotional Instability	3.87	1.93	-.13*	.08	-.12*	-.32**	.57**	-.41**
5 Aggressiveness	3.92	1.69	-.03	.01	-.09	-.13*	.19**	-.22**
6 Vitality	5.37	1.96	.05	.08	.05	.16**	-.10	.12*
7 Achievement Motivation	3.99	1.40	-.04	.07	-.03	.00	.19**	-.05
8 Rigidity	4.17	1.87	-.10	.07	-.01	-.06	.09	-.01
9 Mobility	3.51	1.99	-.09	.12*	-.06	-.14*	.19**	-.14*
10 Openness	4.66	2.11	.05	-.06	-.04	-.04	.13*	-.17**
<i>Social Skills Inventory</i>								
11 Emotional Expressivity	2.48	0.29						
12 Emotional Sensitivity	2.69	0.32	.27**					
13 Emotional Control	2.56	0.29	-.27**	.08				
14 Social Expressivity	2.85	0.37	.56**	.32**	-.07			
15 Social Sensitivity	2.45	0.31	-.08	.16**	-.16**	-.23**		
16 Social Control	3.04	0.31	.27**	.22**	.21	.59	-.45**	

Notes. $N = 292$.

* $p < .05$; ** $p < .01$ (two-tailed).

Table 3a

Uncorrected correlations of AC-dimensions and questionnaire data

	COO	CMT	EMP	SRF	INI	FLX	STR	ICO	OCO
<i>Interpersonal Competence Questionnaire</i>									
Initiation of Interactions and Relationships	-.05	.05	.06	-.11	.17**	-.02	.06	-.02	.11
Assertion of Personal Interests	-.08	-.04	-.02	-.05	-.07	-.16**	.06	-.06	-.08
Self-disclosure of Personal Information	-.08	-.02	-.07	-.06	.00	-.07	-.04	-.08	-.04
Emotional Support of Others	-.03	.02	-.01	-.08	.01	-.09	.04	-.03	-.02
Management of Interpersonal Conflicts	-.05	.00	-.16*	-.18**	.10	-.11	-.07	-.13*	-.03
<i>Social Skills Inventory</i>									
Emotional Expressivity	.04	.19**	.13*	.10	.16*	.05	.17**	.15*	.18*
Emotional Sensitivity	-.02	.05	-.05	.01	.02	.06	.10	.00	.07
Emotional Control	-.03	-.01	-.14*	.02	.06	.01	-.02	-.06	.03
Social Expressivity	.02	.19**	.11	.04	.20**	.04	.20**	.11	.21**
Social Sensitivity	.02	-.09	.07	.07	-.13*	.05	-.05	.03	-.07
Social Control	-.03	.16**	-.03	-.02	.16*	-.05	.20**	.02	.15*
<i>Temperament Structure Scales</i>									
Extraversion	-.07	.05	.08	.01	.09	-.04	-.03	.02	.02
Dominance	.06	.15*	.09	.06	.15*	.09	.11	.11	.16**
Emotional Warmth	-.13*	-.03	-.04	.02	.03	.06	-.07	-.06	.01
Emotional Instability	-.08	-.15*	-.07	-.06	-.10	.03	-.11	-.11	-.09
Aggressiveness	-.07	-.06	-.04	-.04	-.09	.07	.09	-.07	.02
Vitality	-.06	.07	-.05	-.04	.00	.00	-.05	-.03	-.02
Achievement Motivation	-.03	.02	-.02	.04	-.03	.09	.01	.00	.03
Rigidity	.07	.03	.05	.05	-.03	.17**	-.05	.07	.04
Mobility	-.14*	-.05	-.18**	-.04	.04	.00	-.01	-.14*	.02
Openness	.02	.02	-.01	-.02	.05	.06	.09	.00	-.02

Notes. $N = 263$.

COO=Cooperation; CMT=Conflict Management; EMP=Empathy; SRF=Self-Reflection; INI=Initiative; FLX=Flexibility; STR=Stress Resistance; ICO=Interpersonal Competence; OCO=Operational Competence. * $p < .05$; ** $p < .01$ (two-tailed).

Table 5a

Uncorrected correlation matrix of all predictors with training success (TRS) and final grade (FIN₂).

	TSS	EXT	DOM	WAR	EIN	AGG	VIT	AMO	RIG	MOB	OPN
<i>Criteria</i>											
FIN ₂		-.05	.07	-.01	-.10	-.07	.01	.20*	.15*	-.13	.00
TRS		-.12	.00	-.31**	-.16	-.04	-.25*	.07	.15	-.01	-.06
<i>ICQ</i>											
	ICQ	IIR	API	SDC	ESO	MIC					
FIN ₂		-.04	.06	.03	-.02	-.08					
TRS		-.06	-.05	-.09	-.05	.16					
<i>SSI</i>											
	SSI	EEP	ESE	ECT	SEP	SSE	SCT				
FIN ₂		-.02	-.10	.03	-.03	.02	.01				
TRS		-.04	-.24*	.09	-.01	-.10	.06				
<i>AC</i>											
	AC	COO	CMT	EMP	SRF	FLX	INI	STR	ICO	OCO	
FIN ₂		.20*	.32**	.25**	.25**	.22**	.15*	.12	.40**	.27**	
TRS		.15	.09	-.12	.01	.04	.03	.10	.06	-.05	
<i>PER</i>											
	PER	ROT	MAR	CAC	PSP	SIM					
FIN ₂		.04	.15*	.21**	.07	.23**					
TRS		.09	.07	.20*	.18*	.29**					

Notes. *N* = 136 (FIN₂) and *N* = 88 (TRS).

TSS=Temperament Structure Scales; EXT= Extraversion; DOM= Dominance; WAR= Emotional Warmth; EIN=Emotional Instability; AGG=Aggressiveness; VIT=Vitality; AMO=Achievement Motivation; RIG=Rigidity; MOB=Mobility; OPN=Openness; FIN₂=expected career success; TRS=Training Success; ICQ=Interpersonal Competence Questionnaire; IIR=Initiation of Interaction and Relationship; API=Assertion of Personal Interests; SDC=Self-disclosure of Personal Information; ESO=Emotional Support of Others; MIC=Management of Interpersonal Conflicts; SSI=Social Skill Inventory; EEP=Emotional Expressivity; ESE=Emotional Sensitivity; ECT=Emotional Control; SEP=Social Expressivity; SSE=Social Sensitivity; SCT=Social Control; AC=Assessment Center; COO=Cooperation; CMT=Conflict Management; EMP=Empathy; SRF=Self-Reflection; INI=Initiative; FLX=Flexibility; STR=Stress Resistance; ICO=Interpersonal Competence; OCO=Operational Competence; ABI=Cognitive Abilities; ROT=Mental Rotation; MAR=Mental Arithmetic; CAC=Complex Attention Control; PSP=Visual Perception Speed; SIM=Simulator.

p* < .05; *p* < .01 (one-tailed).