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Kristina A. Frey & Wilfried Bos

A psychometric analysis of a large-scale social competence inventory for elementary school children

Abstract

The present study provides a psychometric analysis of a large-scale inventory that consists of a student self-description questionnaire and a parent questionnaire (24 items each) concerning fourth-grade students' social competence. Two aspects of the inventory's construct validity are analyzed: factorial validity is analyzed by examining the factor structure underlying the items through exploratory and confirmatory factor analyses. Convergent and discriminant validity are analyzed in three ways: by examining a multitrait-multimethod (MTMM) matrix of the student and parent questionnaires, gender differences of the inventory's social competence dimensions, and the relationship of the inventory's social competence measures to measures of students' cognitive competence (school grades, standardized test scores and a measure of general cognitive competence). Participants ($N_{\text{students}} = 4,492$, 49 % girls; $N_{\text{parents}} = 3,696$, 63 % female) were part of the German sample of the international school achievement study Trends in International Mathematics and Science Study (TIMSS) 2007. Results suggest that it is largely justified to interpret measures produced by the inventory as appraisals of students' social competence in a large-scale context.

Keywords

Social competence; Elementary school; Psychometric analysis; Construct validity; Large-scale assessment; TIMSS 2007

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Psychometrische Analyse eines Sozialkompetenzinventars für Grundschulkindern im Large-Scale-Kontext

Zusammenfassung

Die vorliegende Studie ist eine psychometrische Analyse eines Inventars zur Einschätzung der Sozialkompetenz von Viertklässlern im Rahmen eines Large-Scale-Settings. Das Inventar besteht aus einem Schüler-Selbsteinschätzungsfragebogen und einem Eltern-Fremdeinschätzungsfragebogen (je 24 Items) zur sozialen Kompetenz von Viertklässlern. Zwei Konstruktvaliditätsaspekte des Inventars werden untersucht: Die faktorielle Validität wird anhand der den Items zugrunde liegenden faktoriellen Struktur über explorative und konfirmatorische Faktorenanalysen untersucht. Konvergente und diskriminante Validität werden in dreifacher Hinsicht untersucht: anhand einer Multitrait-Multimethod-(MTMM-) Matrix des Schüler- und Elternfragebogens, anhand der durch das Inventar produzierten Geschlechtsunterschiede sozialer Kompetenz und zuletzt anhand des Zusammenhangs zwischen den Sozialkompetenzmaßen und Maßen kognitiver Schülerkompetenz (Schulnoten, Schulleistung in standardisierten Leistungstests und ein Maß kognitiver Grundfähigkeit). Die Stichprobe ($N_{\text{Schüler}} = 4492$, 49 % Mädchen; $N_{\text{Eltern}} = 3696$, 63 % weiblich) ist Teil der deutschen Stichprobe der internationalen Schulleistungsstudie Trends in International Mathematics and Science Study (TIMSS) 2007. Die Ergebnisse legen nahe, dass es in einem Large-Scale-Setting weitgehend gerechtfertigt ist, die durch das Inventar erzeugten Maße als Einschätzungen sozialer Kompetenz zu interpretieren.

Schlagworte

Soziale Kompetenz; Grundschule; Psychometrische Analyse; Konstruktvalidität; Large-Scale Assessment; TIMSS 2007

1. Introduction

As a matter of principle, human behavior occurs within a social context (Roth, 1971, p. 386). Consequently, social scientists of diverse disciplines have delineated the importance of social functioning for a successful journey through life: evolutionary psychologists have presented “a ‘social’ hypothesis for the origin of intellect” (Byrne & Whiten, 1992, p. v). Educational psychologists have pointed out the beneficial or detrimental role of social behavior for future social and cognitive outcomes (Wild, Hofer, & Pekrun, 2006, p. 255). Educational economists have revealed the labor market’s increasing demand for skills involving human interaction, understanding, and persuasion (Levy & Murnane, 2007, pp. 167 ff.).

In the present study, we use the term *social competence* for the concept of successful social functioning. Following the definition proposed by Kanning (2002,

p. 155), we understand social competence to mean the entirety of a person's knowledge and abilities benefitting the person's social behavior towards the accomplishment of his or her own objectives while simultaneously adhering to social acceptance.

Within the educational context, the role of schooling for the establishment and stabilization of social competence is often emphasized by research and politics (Fend & Stöckli, 1997; WHO, 1994): "It is beyond doubt that schools are pivotal in promoting social competences" (Klieme, Artelt, & Stanat, 2001, p. 216)¹. The prominent influence on a child's social competence within the surrounding of his or her school is believed to occur informally, through spontaneous daily interactions between students and between students and teachers (Schmidt-Denter, 1999, p. 128). Nevertheless, schools are challenged to foster social competence also formally in their students (House Bill 2437; Jerusalem & Klein-Heßling, 2002, p. 164; KMK, 2005, p. 7).

As a result, numerous studies have investigated how different aspects of social competence can be fostered within the context of school (Jordan & Le Métails, 1997; Petermann, Jugert, Rehder, Tänzler, & Verbeek, 1999; Solomon, Watson, Delucchi, Schaps, & Battistich, 1988; for a review see Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011). Similarly, though far less commonly, large-scale studies on school achievement have begun to include measures of social competence in their focus of assessment (e.g., New Zealand's *Competent Children, Competent Learners* project, New Zealand Ministry of Education, 2008). Such non-academic measures are included in studies traditionally oriented solely towards academic and cognitive outcomes in acknowledgement of school's not only subject-specific educational objectives but also of its generic pedagogical virtue (Baumert & Köller, 1998, p. 18; Klieme et al., 2001, p. 203). More specifically, Klieme et al. (2001, p. 218) deduce five explicit functions of including cross-curricular competences in school achievement studies. Applied to social competence, they read:

- (1) The inclusion of social competence as a focus of assessment within school achievement studies contributes to the specification of what exactly is meant by the term social competence within the context of school,
- (2) it provides assessment means and measures of these specifications within a large-scale context,
- (3) it reveals relationships between social and cognitive aspects of competence,
- (4) it nurtures understanding of the influence of schooling on social competence and
- (5) it indicates deficiencies that merit attention.

The third function is especially noteworthy if large-scale studies provide standardized test scores as measures of cognitive competence. These are called for over and above the more readily obtainable school grades when examining the relationship between social and cognitive competence: School grades can be biased by global

¹ Translation by the authors.

impressions the student leaves on the grading teacher, thus confounding the predictor and the criterion (von Salisch, 2000, pp. 370–371).

A limited number of educational large-scale studies in Germany have included measures of social competence (Baumert et al., 1996; Fend, 1990–1998; Klieme et al., 2001; Lehmann, Gänsfuß, & Peek, 1999) – although the studies themselves do not always refer to all assessed constructs explicitly as aspects of social competence (e.g., Baumert, Köller, & Schnabel, 2000, pp. 33 ff.). By including such measures, these studies have assumed the functions specified above to different extents: These studies have not only furnished detailed information on the development and relationships of sociometric status (Fend, 1998, pp. 262 ff.), information on the development of self-esteem (Trautwein, Lüdtke, Köller, & Baumert, 2006), and information on specificities of social dominance (Jonkmann, Trautwein, & Lüdtke, 2009) but also have provided operationalizations of social competence, references to the level of social competence in schools or school types (e.g., Baumert et al., 2000, pp. 58 ff.; Baumert et al., 2003, pp. 29 ff.; Kunter & Stanat, 2002, pp. 60 ff., 2003, pp. 312 ff.; Lehmann et al., 1999, pp. 77 ff.), data on associations between social and cognitive competence (e.g., Lehmann et al., 1999, p. 74; Trautwein et al., 2006, pp. 341 ff.) and indications as to the amount of influence that school might actually have on the manifestation of students' social competence (e.g., Kunter & Stanat, 2002, pp. 67–68, 2003, pp. 320–321).

So far, however, the mentioned studies have focused exclusively on youth and adolescence: until recently, no educational large-scale study had gathered similar data within German elementary schools. Working within the German division of the international elementary school study *Trends in International Mathematics and Science Study (TIMSS) 2007*, we thus began to develop items suited for administration in a German large-scale study and directed towards the assessment of fourth-grade school children's social competence, as perceived by the children themselves and by their parents. The items were situated within the national student questionnaire and within the national parent questionnaire. The collective of the social competence items in the student questionnaire and in the parent questionnaire is henceforth referred to as the social competence *inventory*.

The inventory should adhere to the first of the above functions by specifying relevant dimensions of social competence within the context of elementary school. It should adhere to the second of the above functions by being an assessment means and by providing assessment measures of the specified dimensions within a large-scale study. It finally should fulfill the third of the above functions by providing a model of the relationship between social and cognitive aspects of competence. A prerequisite for the inventory assuming these functions, though, is a satisfactory demonstration of its psychometric properties. The present study targets this need.

The superordinate purpose of the present study is to provide information for determining whether the inventory serves as an appropriate means for assessing appraisals of fourth-grade students' social competence within a large-scale setting. The information is based on an examination of two aspects of the inventory's construct validity (cf. Hartig, Frey, & Jude, 2007):

- (1) Factorial validity is determined by conducting factor analyses and examining whether the theoretically assumed dimensional structure of the inventory is substantiated empirically.
- (2) Convergent and discriminant validity are determined by examining a multi-trait-multimethod (MTMM) matrix of the intercorrelations of students' self-perceptions and parents' perceptions of students' social competence, expecting higher correlations between corresponding dimensions than between non-corresponding dimensions of social competence.
- (3) The analysis of convergent and discriminant validity further includes the consideration of gender differences revealed by the inventory. Gender differences in social competence are to be expected according to theoretical considerations (Parsons & Bales, 1956, pp. 35 ff.) and according to studies touching the issue and reporting slightly higher levels of prosocial competence among girls (e.g., Eisenberg & Lennon, 1983; Hoffman, 1977; LaFrenière & Dumas, 1992; Whiting & Edwards, 1973; $d = .20$ according to a meta-analysis by Eisenberg & Fabes, 1998, p. 753): "With regard to sex, girls are more prosocial" (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996, p. 1213). Regarding two of the inventory's not explicitly prosocial dimensions – Impulsivity and Assertiveness – theoretical and empirical considerations are ambiguous and – if they suggest differences to be expected at all – suggest boys to be slightly more impulsive and assertive (Kendall & Wilcox, 1979, p. 1025; Maccoby & Jacklin, 1974, pp. 352 ff.; McGee, Williams, & Silva, 1985, pp. 483–484).
- (4) Finally, the analysis of the inventory's convergent and discriminant validity includes the examination of the relationship between the social competence measures produced by the inventory and different measures of students' cognitive competence. Since the beginnings of scientific investigation of social functioning, scholarship has been interested in its relationship to cognitive functioning (for an early review of results see Strang, 1930, pp. 264–265). This interest is not unexpected, considering that the roots of the concept of social competence reach back to the first mention of social *intelligence* (Dewey, 1909, p. 43; Thorndike, 1920, p. 228) and that the concept of intelligence probably is the single scientific concept most commonly equated to cognitive competence. A positive interrelationship between socio-emotional and cognitive aspects of competence has been derived from different theoretical standpoints (e.g., Crick & Dodge, 1994; Humphrey, 1976; Mayer & Salovey, 1997; Piaget, 1981; Wentzel, 1991a), and numerous studies have found empirical evidence in favor of a positive relationship (e.g., Bandura et al., 1996; Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000; Feldhusen, Thurston, & Benning, 1967, 1970; Green, Forehand, Beck, & Vosk, 1980; Rost & Czeschlik, 1994; Wentzel, 1991b, 1993).

2. Method

2.1 Participants

The participants of the study were part of the German sample of TIMSS 2007. TIMSS is an international assessment of student achievement in mathematics and science that has been administered every four years since the year 1995. Germany's participation in 2007 was restricted to elementary school children in grade four (for further background on TIMSS 2007, see Bos et al., 2008, and Mullis et al., 2005).

In 2007, 5,200 school children took part in the TIMSS assessment in Germany. The composition of the sample ensured it to be representative of German fourth-graders in 2007 (Joncas, 2008). The social competence items for students were situated within the national student questionnaire; thus, the student sample underlying the present analysis was restricted to those students in the TIMSS 2007 sample present on the day of questionnaire distribution and equipped with written parental consent to fill in the questionnaire. This restricted sample included 4,492 children, with girls (49 %) and boys (51 %) represented equally. Their average age was 9.95 years ($SD = 0.54$).

The parent sample underlying the present analysis was limited to those persons who provided statements about students from the student sample in question. Elsewhere (Frey, 2013) we have demonstrated that the relevant student sample and the parent sample associated with it are comparable, in terms of important demographic characteristics, to the TIMSS 2007 student sample and to the parent sample associated with the latter. For the children in the student sample ($N = 4,492$), 3,696 parent statements were collected (82 %). In 63 % of cases the questionnaire was filled in by the mother.

2.2 Data collection

Data were collected at the end of the academic year, from April to June 2007 on two consecutive days. Students' participation in the TIMSS tests was compulsory; participation in the student questionnaires and test of general cognitive competence was voluntary and required written statements of parental consent. The national parent questionnaire was distributed by the test administrator on the first day of testing, asking parents to return it to the administrator in the enclosed envelope the next day.

2.3 Variables

The social competence inventory was part of the national student questionnaire (self-perception of social competence) and part of the national parent questionnaire (parents' perceptions of their child's social competence) of TIMSS 2007 Germany. The items had to adhere to the following criteria to be suitable for implementation within TIMSS 2007 Germany: processability within the national background questionnaires; wording appropriate to elementary school children; successful prior usage within the German-speaking area; orientation towards social competence in a non-clinical context; scientific justification for the chosen dimensions of social competence underlying the items.

The lack of a comprehensive instrument adhering to every criterion made it necessary to compile items from scales out of several existing instruments. Concerning the dimensions of social competence to be spanned by the inventory, various models of social competence were considered (e.g., Buhrmester, Furman, Wittenberg, & Reis, 1988; Byrne & Shavelson, 1996; Caldarella & Merrell, 1997; Petermann, 2002; Rose-Krasnor, 1997). We chose Kanning's (2002) model of social competence for its rigorous empirical approach and the explicit and unambiguous description of the resulting dimensions.

Kanning's (ibid.) empirical model of social competence takes account of various conceptions of social competence by applying a lexical approach: the integration of social competence definitions often cited within the field (e.g., Argyle, 1967; Asendorpf, 1996; Buhrmester, Furman, Wittenberg, & Reis, 1988; Consortium on the School-based Promotion of Social Competence, 1996; Kosmitzki & John, 1993; Marlowe, 1986; Petermann, 1995; Riggio, 1986; Schneider & Byrne, 1985) was followed by a broad-based item development and a factor analysis that identified five factors of social competence, described by Kanning in terms of each factor's marker items (see the following brackets)²: *Social Perception* (perspective taking), *Communication* (ability to listen to others and at the same time be verbally influential), *Social Orientation* (to support someone else's cause), *Control of Behavior* (emotional stability), and *Assertiveness* (to realize one's own goals and address conflicts).

Our social competence inventory was based on these five factors of social competence. Following Kanning's (2002) factor descriptions, we assigned a dimension of social competence to each of the five factors and operationalized each of these dimensions through four items from published questionnaire batteries. To represent not only the cognitive (e.g., Wispé, 1986) but also the affective (e.g., Eisenberg & Strayer, 1987; Batson, 1991) aspect of empathy, we assigned two dimensions – *Perspective Taking* and *Empathy* – to Kanning's factor Social Perception. Therefore, Kanning's five factors of social competence were operationalized not by five, but by six dimensions of social competence, each dimension comprising four items, amounting to 24 items in total (see Table 1). The parent questionnaire

2 The factor descriptions in brackets have been slightly condensed for this paper.

used the same wording as the student questionnaire, with *I* being replaced by *My child*. A noteworthy difference between the six dimensions is the explicitly prosocial orientation of the four dimensions Perspective Taking, Empathy, *Regulation of Others' Feelings* and *Prosocial Behavior* on the one hand, and, on the other hand, the dimension Impulsivity, which was neutral in terms of prosocial orientation, and the dimension Assertiveness, which was explicitly non-prosocial. Prior to assessment within TIMSS 2007, a preliminary version of the inventory had been piloted (32 items; $N \approx 220$ fourth-grade students from two large German cities in schools with students of heterogeneous socioeconomic backgrounds) and only items with acceptable psychometric values and items comprehended without any problems by the fourth-graders were retained (see Frey, 2013 for details on the pilot study).

Table 1: Architecture of the student version of the social competence inventory

Kanning (2002)		Student version of the Social Competence Inventory		
Factors	Factor description ^a	Dimension	No. of items	Sample item ^b
Social Perception	perspective taking	Perspective Taking	4	I easily recognize other people's feelings.
		Empathy	4	It makes me sad to see someone being made fun of.
Communication	ability to listen to others and at the same time be verbally influential	Regulation of Others' Feelings	4	I am good at comforting others when they are sad.
Social Orientation	to support someone else's cause	Prosocial Behavior	4	I often share with others (e.g., sweets, toys, colored pencils).
Control of Behavior	emotional stability	Impulsivity	4	I often do or say something without first thinking about it.
Assertiveness	to realize one's own goals and address conflicts	Assertiveness	4	Sometimes I don't say anything although I'm right.
Total: 24 items				

Note. Explicitly prosocially oriented dimensions have been marked in grey.

^a Has been condensed for this paper. ^b Response categories in student version = strongly agree, rather agree, rather disagree, strongly disagree; response categories in parent version = doesn't apply at all, rather doesn't apply, rather applies, applies fully.

As measures of cognitive competence we used (a) the TIMSS 2007 scores of mathematics and science (Olson, Martin, & Mullis, 2008), expressed in so-termed Weighted Likelihood Estimates (Warm, 1985). The Weighted Likelihood Estimates were computed by the authors, using ConQuest (Wu, Adams, Wilson, & Haldane, 2007). The present study also used indicators of achievement that were assessed through the German supplement, namely (b) the grades of the last half-year reports in mathematics and *Sachunterricht* (social studies and science) and (c) a basic measure of students' intelligence, the N2 scale (figure analogies) of the Cognitive Aptitude Test (Kognitiver Fähigkeitstest *KFT* 4-12+R) designed by Heller and Perleth (2000). Since only one scale from the KFT was used, it is reasonable to assume the results to be merely an approximation of intelligence; thus, we ad-

dress this measure not as one of intelligence but rather as one of general cognitive competence.

2.4 Analysis

In the following results, a high item score on the social competence inventory corresponds to an answer generally regarded as favorable according to standard western societal norms. The higher the score, the greater the extent to which the student described him/herself in accordance with such norms or was described as in accordance with such norms. This necessitated a recoding of most items. Thus, the dimension of Impulsivity needs to be understood as “lack of impulsivity”, not as “impulsivity”, if not stated otherwise. School grades were recoded as well, so that a high score corresponds to a good grade. In all correlational analyses, the measures of social competence are modeled as latent constructs.

We examined the construct validity of the inventory by looking at its factorial validity and at three aspects pertaining to its convergent and discriminant validity. Factor validity concerns the question whether the theoretically assumed dimensional structure of the inventory is revealed by the data. If the theoretically postulated structure of the inventory is empirically confirmed, then this may be viewed as support for successful operationalization.

The inventory's dimensional structure was subjected to both exploratory and confirmatory factor analysis. Exploratory factor analysis was required in light of the comparatively slight empirical research existing on the dimensionality of social competence (Caldarella & Merrell, 1997, p. 264; Kanning, 2002, p. 157; exceptions are, e.g., Caldarella & Merrell, 1997; Kanning, 2002; Schneider, Ackerman, & Kanfer, 1996). Confirmatory factor analysis took account of the inventory having been developed from explicitly empirical findings that were based on prior theoretical work (Kanning, 2002). To avoid carrying out both dimensional tests on the same sample, the total student and parent samples were each split into two halves with half of the students of each class and half of their parents being randomly assigned to one of the two samples (Fabrigar, Wegener, MacCallum, & Strahan, 1999, p. 277). Exploratory factor analysis was conducted with the first half-sample and confirmatory factor analysis was conducted with the second half-sample. SPSS 17.0 was used for exploratory factor analysis, carrying out a principal components analysis with subsequent varimax rotation, “since results from orthogonal rotation tend to be more parsimonious” (Kieffer, 1998, p. 17). Following common recommendations (Pedhazur & Schmelkin, 1991, p. 615), we additionally considered the direct oblimin solution. However, “if the difference between the two results is negligible, then the researcher can interpret the orthogonal rotation” (Kieffer, 1998, p. 19). Because the only difference between orthogonal and oblique rotation turned out to be a difference of component order, we do not report the oblique solution. The criteria used for determining the number of extracted components were based on Rost (1987, pp. 182–183): (a) eigenvalues > 1 (Kaiser, 1960; upper limit of compo-

nents); (b) scree-plot: only eigenvalues above the point of inflexion (Cattell, 1966; Cattell & Jaspers, 1967; following Bühner, 2004, p. 183, we permit more than one point of inflexion); (c) at least 3 marker items showing a considerably high factor loading ($\alpha \geq .50$), a significant communality ($\alpha^2/h^2 \geq .50$; Fürntratt, 1969, p. 66), and a general one-dimensionality ($[\alpha_1^2 - \alpha_2^2]/h^2 \geq .25$; Rost & Haferkamp, 1979, p. 186); (d) unrotated components explaining at least 5 % of the total variance; (e) theoretical interpretability of the solution. For the exploratory factor analysis, no account was taken of the nested data structure (students within individual classes).

Mplus 5.2 (Muthén & Muthén, 1998–2007) was used to perform confirmatory factor analysis. The selection of indicators of model fit was based mainly on recommendations produced by Schermelleh-Engel, Moosbrugger, and Müller (2003). Specific program settings took account of the sample being clustered by class and also of all information relating to persons who did not respond to a particular item (FIML procedure).

SPSS 17.0 was used to test for normality of the distribution (Kolmogorov-Smirnov test), and to compute mean (M), standard deviation (SD), and corrected item-total correlation (r_{it}) for each item. Apart from computing mean and standard deviation of each scale, scale reliability was assessed using Cronbach's alpha index of homogeneity. These analyses did not take account of the nested data structure.

Further insights into the issue of construct validity could be obtained from a MTMM matrix (Campbell & Fiske, 1959), examining aspects of convergent and discriminant responding of the inventory. The MTMM matrix was based on inter-correlations of the six social competence scales that emerged as factors in the factor analyses. The six social competence scales represent the six "multitraits" that are assessed through both students' and parents' appraisals, representing the two "multimethods". The overall correlation pattern in the matrix has to meet certain criteria so as to be considered to promote construct validity. Validity is only promoted if, firstly, measures of the same social competence dimension rated by students on the one hand and parents on the other hand result in a high degree of trait convergence (convergent validity) and, secondly, discrimination is possible between the different dimensions of social competence both within the students' and within the parents' rating as well as between students' and parents' rating (discriminant validity). Mplus 5.2 (Muthén & Muthén, 1998–2007) was used to compute correlations for the MTMM matrix. Again, the specific program settings took account of students being nested inside classes and of all information relating to persons who did not respond to a particular item. Because of conducting multiple tests of statistical significance in the correlational analysis, we accounted for the cumulating risk of wrongfully positing statistically meaningful relationships by applying Bonferroni correction to the p -value (Bortz, 1993, p. 249; effective α not higher than .05). We reveal statistical significance within Tables 3, 5 and 6 but we do not consider it beyond that (cf. Rost, 2005, p. 180); instead, we interpret the correlations based on their absolute magnitude directly as effect sizes (small effect: $r \geq .10$; medium effect: $r \geq .25$; large effect: $r \geq .50$; *ibid.*, p. 173).

In addition, we derived information on the inventory's construct validity (convergent/discriminant validity) by considering gender differences of social competence. We determined whether the gender differences displayed by the inventory could be brought in line with empirical findings and theoretical considerations mentioned in the literature. Gender differences were computed using the IEA IDB Analyzer under SPSS 17.0. This is an SPSS plug-in which uses the jackknife procedure (Foy, Galia, & Li, 2008, pp. 267–277) to take account of the clustering of the TIMSS sample, thus avoiding consistent underestimation of the standard deviation. For gender effects, the effect size Cohen's d was computed and its size judged according to Rost (2005, p. 173: small effect: $d \geq 0.20$; medium effect: $d \geq 0.50$; large effect: $d \geq 0.80$).

As a final aspect of the inventory's construct validity (convergent/discriminant validity), correlations were computed between the inventory's six scales of social competence – for both student-perception and parent-perception – and the available cognitive measures (TIMSS achievement, school grades in mathematics and Sachunterricht and a basic test of general cognitive competence). Correlations were computed using Mplus 5.2 (Muthén & Muthén, 1998–2007), accounting for students being nested inside classes and considering all information relating to persons who did not respond to a particular item. Bonferroni adjustment prevented the inflation of the Type I error rate.

3. Results

3.1 Factorial validity

Following Rost's (1987) criteria mentioned in section 2.4 of this paper, five components were extracted from the exploratory factor analysis of the student sample. Table 2 displays the loading matrix. Each of the five components was marked by all four of the items associated with the relevant dimension, with each component accounting, in its unrotated form, for 5 % of the total variance. The variables of the dimension Regulation of Others' Feelings loaded most heavily onto the first component, but only Item 1 from this dimension actually marked the first component, as did the items associated with the Perspective Taking dimension. The loading matrix for parents' perceptions ($n = 1,786$; not shown here) closely resembled the students' loading matrix; a noteworthy difference, though, was that six, not five, components were extracted for the analysis of the parents' appraisals.

Table 2: Factor loadings and communalities of 24 items resulting from exploratory factor analysis with Varimax rotation of $n = 2,009$ students' self-perceptions of social competence

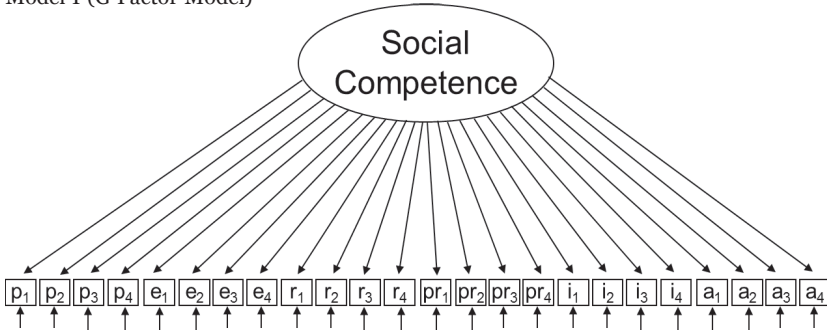
Item number	Component					h^2
	1	2	3	4	5	
Perspective Taking 2	.79	.08	.23	.08	-.05	.70
Perspective Taking 1	.79	.07	.22	.08	-.08	.68
Perspective Taking 4	.78	.12	.13	.06	-.05	.64
Perspective Taking 3	.71	.15	.29	.06	-.09	.63
Reg. of Others' Feelings 1	.58	.44	.14	-.07	.07	.56
Reg. of Others' Feelings 4	.58	.46	.23	-.06	.04	.61
Reg. of Others' Feelings 2	.57	.51	.24	-.05	.01	.64
Reg. of Others' Feelings 3	.56	.44	.10	-.04	.02	.52
Prosocial Behavior 3	.26	.69	.33	.05	.04	.65
Prosocial Behavior 4	.21	.68	.16	.05	-.04	.54
Prosocial Behavior 2	.09	.68	.17	.03	-.07	.51
Prosocial Behavior 1	.13	.64	.13	.25	-.14	.52
Empathy 1	.27	.18	.78	-.01	-.06	.72
Empathy 4	.22	.29	.76	.01	-.08	.72
Empathy 3	.29	.21	.74	-.01	-.05	.68
Empathy 2	.29	.23	.73	-.05	-.10	.69
Impulsivity 2	.00	.05	.01	.84	.13	.73
Impulsivity 1	.03	.00	.04	.80	.13	.66
Impulsivity 4	.02	.14	.00	.78	.14	.64
Impulsivity 3	.06	.03	-.07	.66	.09	.45
Assertiveness 3	.00	-.12	-.09	-.05	.76	.61
Assertiveness 4	-.02	.03	-.07	.11	.72	.54
Assertiveness 2	.02	.03	-.06	.32	.64	.52
Assertiveness 1	-.13	-.08	.00	.26	.61	.47
Total var. explained unrotated (%)	30.6	13.3	6.5	5.6	5.0	61.0
Total var. explained rotated (%)	17.2	12.4	11.7	11.1	8.5	61.0

Note. Marker items [$a \geq .50$, $a^2/h^2 \geq .50$ and $(a_1^2 - a_2^2)/h^2 \geq .25$] are in boldface.

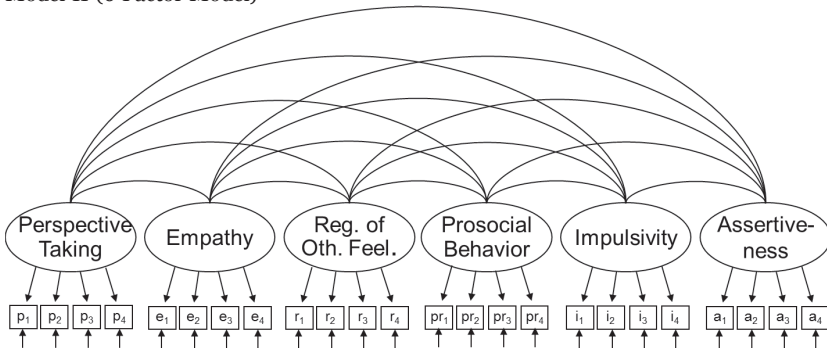
As explained in section 2.4, the second halves of the student and parent data were subjected to confirmatory factor analysis. Four models (represented in Figure 1) were evaluated in terms of their fit to the data.

Figure 1: The inventory's dimensional structure was subjected to confirmatory factor analysis, examining these four models' fit to the data

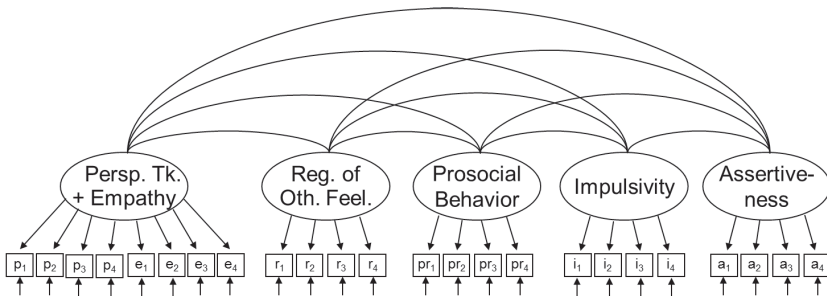
Model I (G Factor Model)



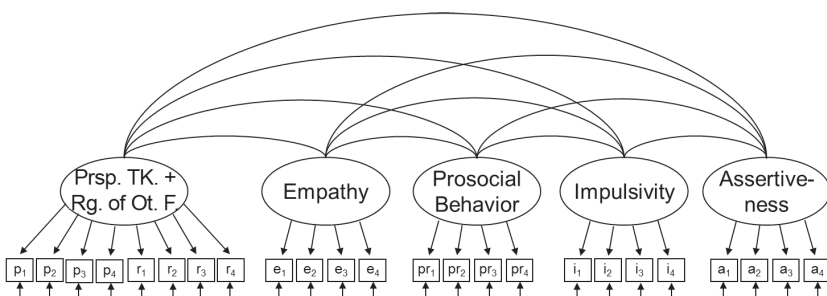
Model II (6 Factor Model)



Model III (Theoretical 5 Factor Model)



Model IV (Empirical 5 Factor Model)



Model I: The basic model to be evaluated was a *g* factor model that assigned all 24 indicators to a single overarching factor termed Social Competence.

Model II: In the second model, each dimension represented its own factor (the result of the exploratory analysis of the parents' statements), but correlation between the scales was allowed.

Model III: As mentioned in section 2.3, Kanning's (2002) factor Social Perception was operationalized via two dimensions, namely Perspective Taking and Empathy. It was therefore theoretically plausible to expect a conflation of these two dimensions, resulting in five distinct but correlating factors.

Model IV: The idea here was to investigate whether the empirical result of the exploratory factor analysis of the students' statements (Table 2) was stable and whether it could be confirmed in a confirmatory analysis. This required a conflation of the dimensions Perspective Taking and Regulation of Others' Feelings, again resulting in five distinct yet correlating factors.

Table 3 shows the fit indicators of the four aforementioned models for student statements and parent statements. Model II, which attributed each of the six times four items to one of six distinct factors, was the only model to show a good to excellent model fit on all the indicators.

Table 3: Fit indices from confirmatory factor analysis of student self-perceptions (*n* = 2,245) and parent perceptions (*n* = 1,971) of their child's social competence

Fit indicator	Model							
	Student				Parent			
	I	II	III	IV	I	II	III	IV
χ^2	6,947.1	698.6	2,426.7	1,779.6	7,470.9	827.9	2,106.8	2,028.4
<i>p</i>	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
χ^2/df	27.6	2.9	10	7.4	29.6	3.5	8.7	8.4
RMSEA	.11	.03	.06	.05	.12	.04	.06	.06
90% CI RMSEA	.11-.11	.03-.03	.06-.07	.05-.06	.12-.12	.03-.04	.06-.07	.06-.06
SRMR	.11	.03	.05	.04	.11	.03	.05	.05
CFI	.60	.97	.87	.91	.58	.97	.89	.90
TLI	.56	.97	.85	.89	.54	.96	.88	.88
AIC	123,140	114,996	117,201	116,382	86,509	78,369	79,899	79,815

Note. Model I = G Factor Model; Model II = 6 Factor Model; Model III = Theoretical 5 Factor Model; Model IV = Empirical 5 Factor Model.

Thus, with regard to parent perceptions, both exploratory and confirmatory factor analysis yielded six factors. With regard to student self-perceptions, the evidence was not quite as unambiguous: five components were extracted on an exploratory basis; confirmatory analysis, however, showed the six-factor model to fit best. We gave preference to the six-factor structure of the student statements, as this seems

well justified on the grounds of the existence of six dimensions and it matches the parent version.

After having revealed substantial agreement between the theoretically posited dimensional structure of the inventory and its empirical structure, social competence *scales* were computed. On the whole, the scales exhibited satisfying homogeneity: Cronbach's alpha indicated sufficient to excellent levels of internal scale consistency for both student self-perceptions ($.68 < \alpha < .87$) and parent perceptions ($.79 < \alpha < .88$). One notable exception was the Assertiveness scale which had a coefficient alpha of .68 for student self-perceptions (Table 4).

Table 4: Descriptive characteristics of the six social competence scales measuring student self-perceptions ($n > 4,000$) and parent perceptions ($n > 3,000$)

	Scale student						Scale parent					
	Perspective Taking	Empathy	Reg. of Oth. Feelings	Prosocial Behavior	Impulsivity	Assertiveness	Perspective Taking	Empathy	Reg. of Oth. Feelings	Prosocial Behavior	Impulsivity	Assertiveness
<i>M</i>	3.04	3.32	3.01	3.50	2.63	2.46	3.19	3.15	2.95	3.43	2.87	2.82
<i>SD</i>	.75	.69	.71	.51	.82	.76	.56	.57	.54	.47	.63	.70
r_{it} -max	.74	.72	.73	.62	.71	.50	.79	.73	.71	.68	.70	.72
r_{it} -min	.69	.69	.66	.50	.50	.42	.68	.66	.67	.57	.55	.64
r_{it} - \emptyset	.72	.71	.70	.55	.62	.46	.74	.70	.68	.61	.62	.67
α	.87	.86	.85	.75	.80	.68	.88	.85	.84	.79	.80	.84

Note. Four items per scale.

3.2 MTMM matrix

Table 5 shows the MTMM matrix for the data of this study. Because of its symmetrical structure it is sufficient to consider only the bottom triangular matrix. It consists of two monomethod triangles (light shading in Table 5) and one multimethod block (dark shading in Table 5). The validity diagonal in the multimethod block is framed.

Table 5: MTMM matrix: correlations among the social competence scales; student self-perceptions and parent perceptions; $n_{students} = 4,024$; $n_{parents} = 3,874$; $n_{students\ and\ parents} = 3,044$

	Scale student						Scale parent				
	Perspective Taking	Empathy	Reg. of Others' Feelings	Prosocial Behavior	Impulsivity	Assertiveness	Perspective Taking	Empathy	Reg. of Others' Feelings	Prosocial Behavior	Impulsivity
Scale student											
Empathy	.61***										
Reg. of Oth. Feel.	.73***	.67***									
Prosocial Behavior	.60***	.66***	.73***								
Impulsivity	.07***	.00	.02	.15***							
Assertiveness	-.12***	-.23***	-.13***	-.09***	.48***						
Scale parent											
Perspective Taking	.25***	.19***	.22***	.22***	.17***	.04					
Empathy	.21***	.29***	.22***	.24***	.09***	-.04	.66***				
Reg. of Oth. Feel.	.24***	.24***	.31***	.27***	.10***	.03	.67***	.67***			
Prosocial Behavior	.16***	.18***	.20***	.28***	.09***	.02	.55***	.65***	.62***		
Impulsivity	.11***	.10***	.08***	.15***	.34***	.10***	.37***	.24***	.29***	.29***	
Assertiveness	.04	-.01	.06*	.03	.04	.25***	.07***	-.05*	.13***	.00	.10***

Note. The multitrait-monomethod triangles are shaded lightly, the multitrait-multimethod block is shaded darker. The validity diagonal is framed. * $p < .05$, ** $p < .01$, *** $p < .001$. All p -values Bonferroni-adjusted. Correlations in thin numbers are not statistically significant ($p > .05$).

Two aspects of the MTMM matrix merit special attention. The first aspect concerns the convergent correlations (validity diagonal of the multimethod block). Between student self-perceptions and parent perceptions the correlations between corresponding scales are consistently higher than those between non-corresponding scales, and the extent of the differences is noteworthy. While the convergent correlations of the validity diagonal are of medium magnitude ($.25 < r < .34$; average correlation $r = .29$), the discriminant correlations of the multimethod block are small at best ($-.04 < r < .24$; average correlation $r = .12$), with one exception ($r_{Prosocial\ Behavior\ (students)\times\ Regulation\ of\ Others'\ Feelings\ (parents)} = .27$). The second aspect worth mentioning is the high correlation between the four explicitly prosocial scales ($.60 < r_{stu-$

$dents < .73$, average correlation $r_{students} = .67$; $.55 < r_{parents} < .67$, average correlation $r_{parents} = .63$; $.16 < r_{students \times parents} < .27$, average correlation $r_{students \times parents} = .22$; average overall correlation across all triangles $r = .43$), compared to the considerably lower correlations between the explicitly prosocial scales and the not explicitly prosocial scales ($-.23 < r_{students} < .15$, average correlation $r_{students} = -.04$; $-.05 < r_{parents} < .37$, average correlation $r_{parents} = .17$; $-.04 < r_{students \times parents} < .17$, average correlation $r_{students \times parents} = .06$; average overall correlation across all triangles $r = .06$). The high correlations between the four explicitly prosocial scales within students' and within parents' rating are the only large correlational effects; they conform to the theoretical expectation that social competence facets being directed towards the well-being of others correlate with each other more strongly than with facets not sharing such contextual similarity.

3.3 Gender differences

With regard to both student perceptions and parent perceptions, the four scales measuring explicitly prosocial competence (Perspective Taking, Empathy, Regulation of Others' Feelings, and Prosocial Behavior) showed slightly more positive assessments for the girls ($0.31 < d_{students} < 0.44$; $0.32 < d_{parents} < 0.36$; table not displayed). As for Impulsivity and Assertiveness, there was some evidence of boys exceeding girls ($p < .05$). But it was without any practical significance in the case of Assertiveness ($d_{students} = -0.05$, $d_{parents} = -0.11$). The gender difference in students' self-appraisal of impulsivity also lacks practical significance ($d = 0.16$). A small effect can be found for parent perceptions of their child's impulsivity ($d = 0.27$), as-signing boys more impulsiveness than girls.

3.4 Relationship with measures of cognitive competence

Overall (Table 6), we found no meaningful correlation between the four scales measuring explicitly prosocial traits (Perspective Taking, Empathy, Regulation of Others' Feelings, and Prosocial Behavior) and measures of cognitive competence ($-.09 < r < .09$, average correlation $r = .00$). There was, however a weak to moderate positive correlation between measures of cognitive competence and the two scales measuring not explicitly prosocial dimensions ($.10 < r_{Impulsivity} < .29$, average correlation $r_{Impulsivity} = .21$; $.10 < r_{Assertiveness} < .21$, average correlation $r_{Assertiveness} = .16$). Two exceptions, though, do not fit this pattern ($r_{Perspective\ Taking \times\ Grade\ Sachunterricht}$ and $r_{Assertiveness\ (parents) \times\ KFT}$).

Table 6: Correlations between student self-perceptions and parent perceptions of their child’s social competence and cognitive competence measures

Cognitive Measure		Scale student						Scale parent							
		<i>n</i>	Perspective Taking	Empathy	Regulation of Oth. Feelings	Prosocial Behavior	Impulsivity	Assertiveness	<i>n</i>	Perspective Taking	Empathy	Regulation of Oth. Feelings	Prosocial Behavior	Impulsivity	Assertiveness
Mathematics	TIMSS 07	4436	.05	-.02	-.06	.01	.25***	.20***	3693	.04	-.04	-.06	-.08***	.15***	.10***
	Grade	3960	.05*	-.02	-.05	.03	.28***	.21***	3258	.07***	-.03	.00	-.04	.22***	.15***
Science	TIMSS 07	4436	.09***	-.03	-.05*	.04	.21***	.19***	3693	.06*	-.01	-.01	-.09***	.10***	.11***
	Grade ^a	3955	.10***	.02	.01	.09***	.29***	.21***	3255	.15***	.04	.03	.00	.23***	.14***
Basic cognitive competence (KFT)		4007	.04	.02	-.05*	.01	.20***	.16***	3293	.05	.01	.00	-.02	.14***	.05

^a The graded subject’s German name is Sachunterricht, cf. end of section 2.3.

* $p < .05$, ** $p < .01$, *** $p < .001$. All p -values Bonferroni-adjusted. Correlations in thin numbers are not statistically significant ($p > .05$).

4. Discussion

The purpose of this study was to present psychometric properties of an inventory, developed as part of the German supplement to TIMSS 2007 and intended to elicit both fourth-grade student self-perceptions and parent perceptions of students’ social competence. The social competence inventory was developed to contribute to the fulfillment of certain functions of cross-curricular competence-assessment within school achievement studies (cf. Klieme et al., 2001, p. 218):

The inclusion of social competence as an assessment-focus within TIMSS 2007 Germany contributes to the specification of what exactly is meant by the term social competence within the context of elementary school. Kanning’s (2002) concise empirical approach appears fruitful as the factors resulting from his analyses can be operationalized for fourth-grade students.

The inventory provides a means of assessment of elementary school children’s social competence appraisals within a large-scale context. Because of the large-scale context of TIMSS 2007, the social competence items had to be implemented within the questionnaires of the study. Behavior observations would have been a more favorable approach from a diagnostic standpoint, considering that the mea-

surement of competence by means of questionnaires bares the risk of a social desirability bias (Bortz & Döring, 2006, pp. 232 ff.). Nevertheless, it is not uncommon (Bastians & Runde, 2002; Reinders, 2008, p. 39) and at times supported (Baumert & Köller, 1998, p. 15; Kanning, 2003, p. 36; Klieme et al., 2001, p. 215; Semrud-Clikeman, 2007, p. 49) to assess non-cognitive competence with questionnaires. Furthermore, the large-scale context must be considered when evaluating the psychometric properties of the inventory: the inventory is not intended for the diagnosis of social competence of an individual child for the purpose of counseling or grading. Instead, as many large-scale assessments, it aims at monitoring strengths and weaknesses of educational programs in different states or regions, mainly to inform administration and politics.

The inventory helps to pursue empirical studies on the relationship of social and cognitive aspects of competence. If the social competence inventory is implemented within large-scale studies including cognitive measures of competence – notably standardized test scores –, the relationship of social and cognitive competence can be scrutinized. The present study does not fulfill this function explicitly because it investigates the mentioned relationship merely as a validation criterion of the inventory. Once the inventory proves a valid instrument it may be used for further research regarding this relationship.

A prerequisite for the inventory assuming these three functions is a satisfactory demonstration of its psychometric properties. Thus, our study addresses aspects of the inventory's construct validity. We feel confident that the results presented approve the inventory's eligibility as an instrument to assess appraisals of fourth-grade students' social competence in a large-scale setting, but limitations must be considered.

On the one hand, the psychometric properties of the inventory revealed on the basis of our sample broadly promote the examined aspects of construct validity: the dimensional structure of the inventory uncovered by the data conforms almost perfectly to theoretical expectations. In the comparison of students' self-perception and parents' perception of their child's social competence, the inventory's corresponding scales correlate higher than the non-corresponding scales, and the explicitly prosocial scales correlate strongly among each other. These two correlational patterns support the interpretation of values produced by the inventory as indicators of students' social competence appraisals. The gender differences concerning the explicitly prosocial scales conform with theoretical expectations and provide further support for the construct validity of these four scales. We had no such definite expectations concerning gender differences of Impulsivity and Assertiveness – if at all, boys were to slightly exceed girls on these scales. Indeed, the girls' advance, apparent on the explicitly prosocial scales, appeared neither on self-perception nor on parent perception of either Impulsivity or Assertiveness. We interpret this lack of discrepancy as being to a certain extent in accordance with what would be expected from the standpoint of construct validity.

On the other hand, the relationship found between the inventory's social competence measures and measures of cognitive competence partly contradict expect-

ed findings. Meaningful correlations were revealed only with respect to the not explicitly prosocial scales Impulsivity and Assertiveness, which is in line with prior results (e.g., Bandura et al., 1996; Costa, Terracciano, & McCrae, 2001; Maccoby & Jacklin, 1974, p. 265). We found no meaningful relationship between explicitly prosocial scales and measures of cognitive competence, although we would have expected such a link (cf. e.g., Caprara et al., 2000; Feldhusen et al., 1967, 1970). We would have expected such a link even though Eisenberg and Fabes (1998, p. 279) point out that there is also considerable empirical evidence to the contrary (see also Rindermann, 2009, pp. 18–19, or Weinert, Helmke, & Schrader, 1988, p. 232) because we consider the theoretical rationale for the expectation of a positive relationship (e.g., Crick & Dodge, 1994; Humphrey, 1976; Piaget, 1981) stronger than the empirical evidence provided to the contrary of this expectation. Thus, our own empirical evidence failing to demonstrate a positive interrelationship might be interpreted as an indicator of imperfect construct validity. If it is not an indication detrimental to the inventory's construct validity, it might be an effect singular to the studied sample and should be reexamined on the basis of a different sample.

Generally, further analyses are necessary to provide a more complete evaluation of the inventory's validity. Within the frame of this study, only certain construct validation aspects were considered, and these were considered only on the basis of a single – albeit large and representative – sample. Preferably, the inventory will undergo further tests of its psychometric properties on the basis of various samples and additional validation criteria. For example, the important question of criterion validity remains unresolved within this study: other measures of students' social competence are necessary to evaluate the extent to which the inventory actually measures students' social competence. Behavior observations or actual achievement scores of students' social competence would be ideal as external validation criteria for students' self-appraisal of their own and parents' appraisal of their child's social competence (although achievement scores of students' social competence as yet seem to remain a pious hope, cf., e.g., Kanning, 2003, p. 39). Teacher assessments of students' social competence (cf., e.g., Frey & Bensen, 2012) would be an alternative instructive supplement to validation. Nevertheless, the preliminary analysis of the inventory's psychometric properties provided by this study suggests it is largely justified to interpret measures produced by the inventory in a large-scale context as appraisals of students' social competence.

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