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# The Three Dimensions of the Student–Teacher Relationship Scale: CFA Validation in a Preschool Sample

Elisabet Solheim<sup>1,2</sup>, Turid Suzanne Berg-Nielsen, PhD<sup>2</sup>, and Lars Wichstrøm, PhD<sup>1,3</sup>

## Abstract

The validity of the Student–Teacher Relationship Scale (STRS) was examined in a preschool community sample ( $N = 925$ ) using confirmatory factor analysis (CFA). Factorial invariance across genders was also investigated as was concurrent and discriminant validity. Indicators of validity were teacher-rated social competence, problem behavior, and mental health, as well as the children's score on the Peabody Picture Vocabulary Test. Results showed that the original three-dimensional model of the STRS was not satisfactorily confirmed. However, a slightly modified 25 items, 3-factor version of the STRS showed an acceptable fit. Model fit was acceptable for both boys and girls. The modified three-factor model evidenced good concurrent validity. The discriminant validity of the dependency versus the conflict subscale was somewhat unsatisfactory, mainly due to imperfections in the dependency subscale.

## Keywords

Student–Teacher Relationship Scale, preschool children, confirmatory factor analysis, community sample, dependency

Research has shown that a positive teacher–child relationship is fundamental to a child's healthy development (Hughes, Cavell, & Jackson, 1999; Ladd & Burgess, 2001; O'Connor & McCartney, 2007; Silver, Measelle, Armstrong, & Essex, 2005). A negative teacher–child relationship may, on the other hand, have a negative impact on development (Birch & Ladd, 1997; Doumen et al., 2008; Hamre & Pianta, 2001). The quality of early teacher–child relationships is especially important for children at risk for maladaptive development (Hamre & Pianta, 2005; Justice, Cottone, Mashburn, & Rimm-Kaufman, 2008; Meehan, Hughes, & Cavell, 2003).

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The most widely used instrument in the study of teacher–child relationships for children between the ages of 4 and 9 is the Student–Teacher Relationship Scale (STRS; Pianta, 2001). The STRS is designed to measure teacher–child relationships from the teacher’s perspective along the dimensions of *closeness*, *conflict*, and *dependency*. Very few studies have used the full STRS scale with preschool samples (children under the age of 5; Doumen et al., 2009; Palermo, Hanish, Martin, Fabes, & Reiser, 2007; Rudasill, Rimm-Kaufman, Justice, & Pence, 2006). With few exceptions, internal consistency has typically been the only reported evidence of STRS’s psychometric properties. Doumen et al. reported some evidence for convergent validity of the closeness and conflict scales, and to a lesser extent, their discriminant validity. They did not examine the dependency subscale or the factorial structure (i.e., measurement model). One study did however test the factorial validity in a preschool sample and found support for a 26-item modified measurement model (Webb & Neuharth-Pritchett, 2011). Their findings also suggested different measurement models across ethnic groups. Because of a limited sample size they could not investigate the measurement models’ invariance across gender, an important addition in establishing STRS’s validity. Moreover, the children participating in the study were part of an early childhood literacy intervention; thus, generalizability of the findings may be limited. Consequently, we still know relatively little about teacher–child relationships in preschool and whether the STRS is a valid measure of teacher–child relationships in preschool populations.

## The Student–Teacher Relationship Scale

The STRS was developed by Pianta and Nimetz (1991) based on attachment theory and research on parent–child and teacher–child relationships. The closeness subscale, which consists of 11 items, measures the degree to which a teacher experiences affection, openness, and warmth with a particular child (e.g., “I share an affectionate, warm relationship with this child”). The 12 conflict items measure the level of discord within the teacher–child interaction (e.g., “This child easily becomes angry at me”). The dependency subscale containing five items measures teachers’ perception of possessive, clingy behaviors seen in children who rely too much on teachers for help and support (e.g., “This child is overly dependent on me”). The scale also yields a total score that reflects the overall quality of the teacher–child relationship (Pianta, 2001). The STRS has been translated into Norwegian in accordance with standard translation protocol (Drugli & Larsson, 2006).

### Preschoolers Versus School Children

The older the children, the more the teachers have rated the relationship as conflictual and dependent (Pianta, 2001; Saft & Pianta, 2001). Younger children (under the age of 5) have been found to have closer relationships with their teachers (Justice et al., 2008; Pianta, 2001). Age differences found are based on the assumption that the STRS remains the same across ages and school settings. Yet this has, to our knowledge, never been tested.

Theoretically, the operationalization of dependency for both preschool and school children may be particularly challenging. As the school setting gradually shifts toward more formal instruction and clearer academic goals, the behavior considered dependent also changes. What is considered clingy, needy, and dependent behavior for a 6-year-old might be considered more appropriate behavior for a 4-year-old.

The dependency subscale has shown lower reliability in terms of internal consistency than both closeness and conflict; Cronbach’s alpha ranging from .41 to .69. Consequently, some researchers have either dropped the subscale or combined it with conflict (Rydell, Bohlin, & Thorell, 2005). Others have used a shortened two-factor (closeness and conflict) version with 15 items (STRS-SF; NICHD ECCRN, 2003; Mashburn, Hamre, Downer, & Pianta, 2006). As a consequence information on dependency’s validity is largely lacking.

## Concurrent and Discriminant Validity

High scores on the closeness subscale have been linked with positive outcomes (O'Connor & McCartney, 2007; Palermo et al., 2007), whereas high scores on the conflict and/or the dependency subscale have been linked with lowered language competency, diminished academic readiness in preschoolers, lack of sociability, and behavioral and emotional problems (Palermo et al., 2007; Pianta, Nimetz, & Bennett, 1997).

There are a few studies, notably with older children, who lend support to dependency's discriminant validity, separating it from conflict. Conflict tends to be more strongly linked to externalizing symptoms (i.e., being aggressive and defiant) as well as antisocial behavior toward peers (Doumen et al., 2008). To a large extent, dependency is associated with internalizing symptoms (i.e., withdrawal and anxiety; Murray & Murray, 2004).

Although gender differences in general are less pronounced in preschoolers, some evidence exists that teachers perceive their relationships with boys as more conflictual (Howes, Phillipsen, & Peisner-Feinberg, 2000; Justice et al., 2008) and their relationships with girls as closer. There are no consistent patterns between gender differences and dependency.

## The Current Study

The current study aims to extend the existing research in several ways. First we use confirmatory factor analysis to establish the factorial validity of the full STRS scale in a preschool community sample. This has never been done before. Our main research questions are as follows:

*Research Question 1:* Is the full three-factor STRS a valid tool for measuring preschool children's relationships with their teachers?

*Research Question 2:* Is there equivalence of factorial validity across gender?

*Research Question 3:* Finally, we investigate the concurrent and discriminant validity of all three subscales.

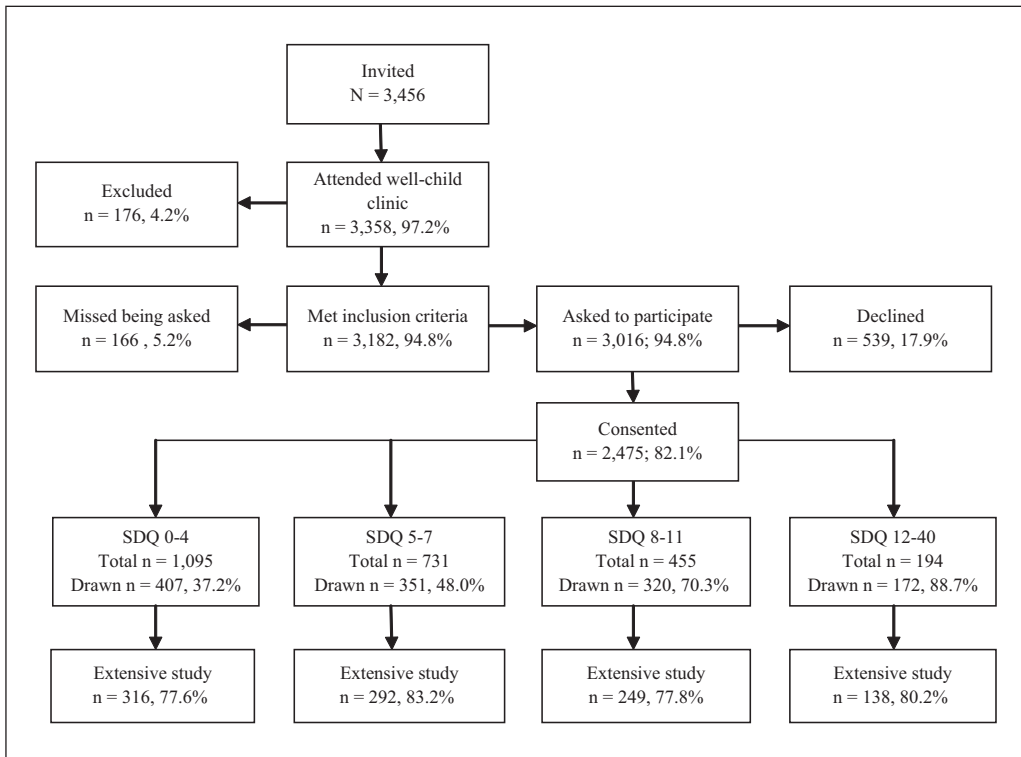
## Method

### Participants and Recruitment

All children born in 2003 or 2004 with parents living in the city of Trondheim, Norway, were invited to participate in the study. A letter of invitation together with the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) were sent to the participants' homes to use as a screening instrument. Parents brought the completed SDQ to their child's health checkup at local clinics that all Norwegian 4-year-olds (are supposed to) undergo. Figure 1 presents a flow-chart describing the recruitment procedure and participant rates.

An overwhelming majority of children invited appeared at the city's well-child clinics. Parents with insufficient proficiency in Norwegian to fill out the SDQ screen were excluded from study recruitment. The health nurse at the well-child clinic informed the parent about the study using procedures that were approved by the Regional Committee for Medical and Health Research Ethics and obtained written consent to participate. However, as seen in Figure 1, the staff at the well-child clinics did not ask 100% of families to participate. The consent rate among eligible families was 82.1%.

SDQ scores on the symptom scales (viz., emotional symptoms, conduct problems, hyperactivity/inattention, and peer relationship problems—20 items) were divided into four strata with cutoffs of 0 to 4, 5 to 8, 9 to 11, and 12 to 40. Using a random number generator, defined proportions (see Figure 1) of parents in each stratum were drawn to participate in the more extensive study



**Figure 1.** Sample recruitment

following the health checkup. Children at risk for developing (or already manifesting) behavior problems were oversampled. Of the 1,252 parents who were invited at this stage, 995 (79.5%) participated. The drop-out rate after consenting at the well-child clinic did not differ across the four SDQ-strata ( $\chi^2 = 5.70$ ,  $df = 3$ ,  $ns$ ) or gender ( $\chi^2 = 0.23$ ,  $df = 1$ ,  $ns$ ).

The STRS was sent to the child's daycare center after parents provided their written consent. It was specified that the preschool employee who best knew the child should answer the questionnaire. Of those families who did not want to participate in the more extensive study, 35 of the 255 parents still gave their consent to send the STRS to their child's daycare center. The response rate from the daycare centers was 90%, thus leaving a slightly smaller sample for the current study ( $N = 931$ ). Six participants had incomplete data. The final sample analyzed consisted of 458 girls and 467 boys with a mean age of 54.7 months ( $SD = 3.02$ ). The preschool teachers, 86.2% women and 13.5% men, had a mean age of 38.2 years, ranging from 22 to 70 ( $SD = 8.7$ ). Overall, they had extensive experience working with children ( $M = 13.3$  years,  $SD = 8.6$ ) and had known the child in question on an average of 18.8 months ( $SD = 10.95$ ).

## Measures

### Indicators of Validity

**Mental health and problem behavior.** The Teacher Report Form (TRF) for ages 1½ to 5 years of the ASEBA preschool version (Achenbach & Rescorla, 2000) was used to assess children's problem behavior. Based on previous research on the validity of the STRS, the following TRF subscales were found to be relevant, and thus, are used in the current study: internalizing,

externalizing, aggressive and withdrawn behavior, as well as the following TRF *DSM*-oriented problem scales: affective, anxiety, and oppositional defiant problems. Cronbach's alpha ranged from .63 (*DSM*-oriented problem scale; anxiety) to .95 (externalizing behavior) for the TRF scales used.

**Social competence.** We used the 30-item teacher report form of the Social Skills Rating System (SSRS; Gresham & Elliot, 1990) to assess the children's social skills. The total scale was used in analyses (Cronbach's alpha = .81).

**Language skills.** A Norwegian adaptation of The Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997) provided a measure of receptive language comprehension. The adaptation was done based on a pilot study of 17 four-year-olds who completed the PPVT after its instruction had been translated into Norwegian. Based on the pilot study, a few alterations in word order were made to ensure that the words were presented to the child with increasing complexity/difficulty. The PPVT correlates well with other measures of vocabulary, intelligence, achievement, and language and has shown satisfactory reliability and validity (Dunn & Dunn, 1997; Williams & Wang, 1997). In our sample, Cronbach's alpha was .98.

## Analysis

The oversampling procedure described necessitated the use of a Huber–White sandwich estimator (Huber, 1967; White, 1980) to arrive at the correct estimations for the population. Confirmatory factor analysis (CFA), multigroup CFA and CFA with covariates (MIMIC; multiple indicators, multiple causes), and bivariate correlations were used to address the research questions concerning factorial and concurrent/discriminant validity, respectively. The analyses were conducted using Mplus 5.2 (Muthén & Muthén, 2007). For the bivariate correlations, family-wise error rates were controlled with Bonferroni correction. The significance level was set to  $p < .001$  (see Table 6).

Initial data diagnostics indicated that the observed responses on the STRS were discrete realizations of a limited number of categories on most items. An assumption of continuity was thus broken and data were handled as categorical using a weighted least square estimator (WLSMV; Flora & Curran, 2004; Nussbeck, Eid, & Lischetzke, 2006). Goodness of fit was evaluated applying the  $p$  value of the  $\chi^2$  goodness of fit statistics (Chi-P), the comparative fit index (CFI), the Tucker–Lewis Index (TLI), the root-mean-squared error of approximation (RMSEA), and the weighted root-mean-squared residual (WRMR). Good model fit was defined by Chi-P  $\geq 0.05$ , TLI  $\geq 0.95$ , CFI  $\geq 0.95$ , RMSEA  $\leq 0.05$  or  $0.06$ , and WRMR close to 1.0 under moderate non-normality (Yu, 2002). When determining the model's goodness of fit, however, it is, according to Brown, just as important to consider the model's parameter estimates as it is to consider the fit indices outlined above. Thus, we also examined model fit on the basis of each item's  $R^2$  and factor loadings ( $\geq .40$ ). Low  $R^2$  for an item indicates high levels of error and is considered an estimate of the item's reliability (Brown, 2006). In terms of model modification, we considered modification indices (MI) above 10 coupled with high expected parameter change (EPC; that is,  $\geq .40$ ). A  $\chi^2$  difference test, suitable for analyses conducted with the WLSMV estimator, was performed to compare the fit of nested CFA models (Muthén & Muthén, 2007).

Three a priori models were postulated and tested for the three-factor STRS. Model 1 examined the unidimensionality of the STRS. This was deemed a less likely hypothesis but considered as an important step in establishing the STRS factor structure. Model 2 was a two-dimensional model that was based on previous research (Rydell et al., 2005); it synthesized the conflict and dependency scale into one latent construct thought to measure a negative relationship quality. The third model examined the multidimensionality of the STRS (Model 3). Item 28 (“My interactions with this child make me feel effective and confident”) was allowed to load on both

**Table 1.** Confirmatory Factor Analysis Results for the STRS and Results for  $\chi^2$  Difference Test for Nested Models

Model alteration	Chi-P	CFI	TLI	RMSEA	WRMR	$\chi^2$ difference (df)
Model1: One factor	0.00*	0.62	0.76	0.13	2.95	280.42 (4)*
Model2: Two factors	0.00*	0.84	0.90	0.09	2.00	78.77 (2)*
Model3: Three factors	0.00*	0.85	0.91	0.08	1.89	—

Note: Chi-P =  $\chi^2$  goodness of fit statistics; CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root-mean-squared error of approximation (RMSEA); WRMR = weighted root-mean-squared residual.

\* $p < .00001$ .

conflict and closeness as this was specified in the original model (Pianta, 2001). All three factors were allowed to correlate as it was postulated that observed variables were manifestations of three first-order latent variables. In all models, it was hypothesized that the measurement error associated with each item variable would be uncorrelated with each other.

After establishing the factorial validity of the STRS, a number of correlational analyses were conducted to investigate the concurrent and discriminant validity. Differences between  $r$ 's were tested by a  $z$  score using Fisher's transformation of  $r$  (Fisher, 1915).

## Results

### Factor Structure

The results of the CFA for the full STRS are presented in Table 1. All fit indexes regarding the unidimensionality of the STRS in Model 1 suggested that the hypothesis should be rejected. Model 2 with two dimensions gave a better fit to the data than Model 1, and specifying three dimensions in Model 3 further improved the fit. As seen in the far right column of Table 1, restricting the models from three to two factors and from two to one factor significantly degraded the fit of the model. Although the three-dimensional model (Model 3) yielded the best fit to the data, the fit was only considered marginal. In addition, Items 12 ("This child tries to please me") and 21 ("I've noticed this child copying my behavior or ways of doing things") on the closeness subscale and Item 6 ("This child appears hurt or embarrassed when I correct him/her") had factor loadings under 0.40 and low ( $<.20$ )  $R^2$ . The conflict and closeness subscales were moderately negatively correlated ( $r = -.40$ ). The dependency subscale showed a high positive correlation ( $r = .67$ ) with the conflict subscale and a low negative correlation with the closeness subscale ( $r = -.14$ ).

### Test for Alternative Measurement Model

Because the hypothesized factor model yielded an inadequate model fit, subsequent CFAs were carried out to identify the sources of model misfit and to establish a statistically and substantively viable model. However, single-sample post hoc modifications risk capitalizing on sample-specific variance, and thus, spuriously inflate model fit. To circumvent this problem, taking advantage of our large sample, we split the sample into strictly random halves ( $N = 463$  and  $N = 462$ ). This allowed us to explore modifications of the STRS model in one half (Sample A) and then cross-validate the final model in the second half (Sample B).

By testing the three a priori models outlined for the whole sample in Sample A, we first established that the three-factor solution gave the best fit to the data. The three-factor solution in Sample A was less than adequate, and similar to the fit found in the whole sample (CHI-P = 0.00000, CFI = 0.88, TLI = 0.92, RMSEA = 0.08, WRMR = 1.46).

**Table 2.** Fit Indices of Modified Model for Samples A and B and Whole Sample

Sample	Chi -P	CFI	TIL	RMSEA	WRMR
Sample A	0.00*	0.94	0.96	0.06	1.14
Sample B	0.00*	0.94	0.96	0.06	1.08
Whole sample	0.00*	0.94	0.96	0.06	1.34

Note: CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root-mean-squared error of approximation; WRMR = weighted root-mean-squared residual.

\* $p < .00001$ .

Modification indices (MI) were examined as a guide in search for model misspecification. The first modification involved allowing the measurement error of Item 9 (“This child spontaneously shares information about him/herself”) and 27 (“This child openly shares his/her feelings and experience with me”) to be correlated. This parameter was associated with the largest MI (25.54) and EPC (.71). We also allowed a cross loading from Item 15 (“It is easy to be in tune with what this child is feeling”; MI = 11.67, EPC = .42). Items 9, 27, and 15 did indeed share common themes and wording. Then we allowed a negative cross-loading from Item 24 (“Despite my best effort I am uncomfortable with how this child and I get along”), a conflict item to the closeness scale (MI = 10.52, EPC = -.25).

Items 12 (“This child tries to please me”), 21 (“I’ve noticed this child copying my behavior or ways of doing things”), and 6 (“This child appears hurt or embarrassed when I correct him/her”) showed consistently low factor loadings (<0.40) and very low  $R^2$  estimates (<.25) and were deleted from the model one by one. Taken together, as seen in Table 2, these changes gave the model an acceptable fit. Further inspection of Table 2 shows that this modified measurement model replicated well in the other half of the sample (Sample B) as well as in the whole sample. Factor loadings and  $R^2$  for all three samples are presented in Table 3, and the correlations among factors are shown in Table 4.

### Factorial Invariance Across Gender

Multigroup CFA was conducted with the modified measurement model to test equivalence of factorial validity across gender. The first step was to ensure that the posited three-factor model was acceptable in both groups (Girls:  $N = 458$ , Boys:  $N = 467$ ). Inspection of Table 5 shows a better model fit for boys than for girls, but both are considered acceptable. Next, we conducted the simultaneous analysis of equal form (i.e., least restricted solution). This showed a less-than-acceptable fit (Chi- $p = 0.0000$ , CFI = 0.91, TLI = 0.94, RMSEA = 0.07, WRMR = 1.99). We then restricted the factorial means, setting them to 0 one at a time for males, assuming nonequality. The equality constraint on the factor means for closeness, did significantly, although modestly, degrade the fit of the model, indicating that girls and boys did differ in their average levels of the underlying dimension of closeness,  $\chi^2(1) = 5.874$ ,  $p < .05$ .

To further examine this gender invariance, we conducted MIMIC analyses with gender as a covariate. This showed a significant negative effect of gender on closeness (unstandardized estimate = -0.15,  $p < .01$ ), and no effect on dependency and conflict, indicating that boys have a lower factor mean on closeness than girls do. Next, the invariance of thresholds across genders was investigated by fixing the direct effect between gender and each factor indicator to zero and inspecting the resulting MI values. Item 4 was the only item to exceed the a priori MI criterion of >10 (MI = 26.84). Multigroup analysis revealed that this was due to a slightly higher factor loading among girls for Item 4 on closeness than among boys (-.56 vs. -.49).



**Table 3.** Standardized Factor Loadings of the Modified Measurement Model for Sample A and B and Whole Sample ( $R^2$  Values Presented in Parentheses)

Scale	Item	Sample A	Sample B	Whole sample
Conflict	Item 2	0.77 (.59)	0.81 (.66)	0.78 (.61)
	Item 11	0.87 (.75)	0.77 (.60)	0.83 (.68)
	Item 13	0.69 (.48)	0.71 (.50)	0.70 (.49)
	Item 16	0.69 (.48)	0.67 (.45)	0.67 (.45)
	Item 18	0.73 (.53)	0.67 (.45)	0.70 (.59)
	Item 19	-0.48 (.23)	-0.34 (.12)	-0.42 (.17)
	Item 20	0.84 (.71)	0.85 (.72)	0.85 (.72)
	Item 22	0.79 (.62)	0.72 (.51)	0.75 (.56)
	Item 23	0.86 (.74)	0.88 (.77)	0.87 (.75)
	Item 24	0.67 (.66)	0.65 (.74)	0.66 (.69)
	Item 25	0.68 (.46)	0.58 (.34)	0.63 (.40)
	Item 26	0.76 (.58)	0.74 (.54)	0.74 (.55)
	Item 28	-0.34 (.51)	-0.25 (.48)	-0.30 (.50)
	Closeness	Item 1	0.75 (.56)	0.69 (.48)
Item 3		0.61 (.37)	0.62 (.38)	0.61 (.37)
Item 4		-0.48 (.23)	-0.57 (.32)	-0.51 (.26)
Item 5		0.73 (.54)	0.79 (.62)	0.76 (.58)
Item 7		0.51 (.26)	0.51 (.26)	0.51 (.26)
Item 9		0.50 (.25)	0.54 (.29)	0.52 (.27)
Item 15		0.53 (.28)	0.66 (.44)	0.59 (.35)
Item 24		-0.25 (.66)	-0.39 (.74)	-0.32 (.69)
Item 27		0.65 (.43)	0.71 (.51)	0.68 (.47)
Item 28		0.50 (.51)	0.58 (.48)	0.54 (.50)
Dependency	Item 8	0.66 (.44)	0.69 (.48)	0.68 (.46)
	Item 10	0.60 (.36)	0.70 (.50)	0.66 (.44)
	Item 14	0.68 (.46)	0.55 (.30)	0.62 (.38)
	Item 17	0.81 (.65)	0.72 (.51)	0.77 (.59)

Note: All standardized factor loadings were statistically significant at  $p < .001$ .

### Concurrent and Discriminant Validity

Table 6 presents correlations between the modified STRS model and indicators of validity. In general, the three subscales correlated as hypothesized with the behavioral measures included.

### Dependency Versus Conflict

As seen in Table 6, correlational differences between conflict and dependency and the validation measures were only significant for boys. Conflict showed significantly higher negative correlations with social competence than dependency did. There was also a significant difference between dependency and conflict in terms of their association with aggressive behavior, oppositional defiant behavior, and externalizing problems.

### Discussion

This study examined the validity of the STRS in a large preschool community sample using confirmatory factor analysis (CFA) and examined factorial invariance across gender. Subsequently,

**Table 4.** Correlations Among Latent Constructs of STRS (Student–Teacher Relationship Scale) in the Modified Measurement Model

Subscale	Conflict	Closeness	Dependency
Sample A (N = 463)			
Conflict	—	−0.44***	0.65***
Closeness	−0.44***	—	−0.19**
Dependency	0.65***	−0.19**	—
Sample B (N = 462)			
Conflict	—	−0.32***	0.73***
Closeness	−0.32***	—	−0.01
Dependency	0.73***	−0.01	—
Whole sample (N = 925)			
Conflict	—	−0.37***	0.67***
Closeness	−0.37***	—	−0.10*
Dependency	0.67***	−0.10*	—

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

**Table 5.** Fit Indices for the Modified Model for Girls and Boys

Sample	Chi-P	CFI	TIL	RMSEA	WRMR
Girls	0.00*	0.94	0.96	0.06	1.14
Boys	0.00*	0.94	0.96	0.06	1.08

Note: Chi-P =  $\chi^2$  goodness of fit statistics; CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root-mean-squared error of approximation; WRMR = weighted root-mean-squared residual.

\* $p < .00001$ .

concurrent and discriminant validity of the identified factors were examined. The results showed that a slightly modified three-factor version of the STRS showed an acceptable fit for both boys and girls, and we only found weak indications of measurement noninvariance. The modified STRS subscales showed acceptable concurrent validity. In addition, discriminant validity for closeness versus conflict and dependency was good. The discriminant validity of dependency versus conflict was only partially confirmed.

### *Ambiguous Items in the STRS Subscales*

We found that Items 6, 21, and 12 had potentially poor psychometric properties. Item 6 loaded significantly lower on the dependency subscale as compared to the other dependency items and showed consistently low factor loadings (i.e.,  $<0.40$ ) and low  $R^2$ . Similar problems have been pointed out by others (Gregoriadis & Tsigilis, 2008; Webb & Neuharth-Pritchett, 2011) indicating that Item 6 may not be measuring the same construct as the other items on this scale.

Item 21, originally a closeness item, did not show satisfactory factor loadings on any of the scales ( $<0.40$ ) and showed consistently low  $R^2$  estimates as well. Similar results have been reported for kindergarten children (Gregoriadis & Tsigilis, 2008; Rydell et al., 2005) and in the recent validation study from Webb and Neuharth-Pritchett (2011). Our findings may be a further indication of the ambiguity of these items, and we suggest that these items be removed from the scale. In addition, it is worth noting that Item 21 was one of the two items (Item 6 being the other) that had the lowest item–total correlation in the original version of the scale.

**Table 6.** Correlations, and Difference in Correlations Between STRS Factor Scores, Child Competencies (PPVT-III and SSRS), Problem Behavior (TRF), and Mental Health (TRF) Presented by Gender

	Closeness		Conflict		Dependency		Difference between associations with dependency and conflict—z scores	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
	Competence							
Rec. language comprehension	0.09	.19**	-.07	-.11	-.004	-.14	-0.95	0.46
Social competence (total)	0.57**	.55**	-.68**	-.57**	-.31**	-.51**	-7.63**	-1.43
Problem behavior/mental health								
Withdrawn behavior	-.33**	-.32**	.31**	.18**	.20**	.13	1.74	0.76
Aggressive behavior	-.20**	-.14*	.46**	.38**	.22**	.32**	4.20**	1.08
Internalizing problems	-.31**	-.29**	.37**	.30**	.27**	.30**	1.69	-0.03
Externalizing problems	-.22**	-.16**	.46**	.38**	.23**	.31**	4.15**	1.2
Affective problems	-.20**	-.16**	.17**	.23**	.17**	.23**	-0.02	0.06
Anxiety problems	-.10	-.20**	.19**	.20**	.19**	.27**	0.09	-1.12
Oppositional defiant problems	-.19**	-.15**	.40**	.34**	.16*	.25**	4.00**	1.54

Note: STRS = Student-Teacher Relationship Scale; PPVT-III = The Peabody Picture Vocabulary Test; TRF = Teacher Report Form.

\* $p < .001$ . \*\* $p < .0001$ .

Item 12 (“This child tries to please me”) showed a negative and very low factor loading on the closeness subscale and did not show satisfactory  $R^2$  estimates. In the original model proposed by Pianta, this item had a positive loading on the scale. It seems that the problematic psychometric properties may be attributable to ambiguous item content. “To please” may be interpreted as something positive as part of a cooperative relationship, but it may also be interpreted negatively, that is, something the child does in order to obtain an advantage or benefit. It seems as if Norwegian preschool teachers have endorsed the latter. No other researchers have reported similar results. Further research with other samples is required to draw conclusions about the future inclusion and allocation of Item 12 in the scale.

### *Interpretation of the Dependency Subscale With Preschoolers and Cultural Differences*

There has been some controversy in the literature as to whether the dependency subscale should be interpreted as a positive or a negative relationship quality. Gregoriadis and Tsigilis put forth that teachers’ perceptions of conflict and closeness might be culturally robust whereas perceptions of dependency might be culturally dependent and more affected by the setting in which the caregiver-child dyad functions. The Greek authors argue that dependency can be seen as a positive relational quality in light of their Greek, collectivistic culture. We, on the other hand, found a somewhat higher negative correlation between dependency and conflict (ranging from .65 to .73) than originally found for the STRS scale (Pianta, 2001). Norwegian society is more

similar to North American society; both may be regarded as individualistic cultures that value autonomy and self-assertion. In the Norwegian daycare system, individualistic ideals prevail and children over the age of 3 are expected to be competent, self-assertive, and independent. It seems that Norwegian preschool teachers interpret dependency as something particularly negative, even for children as young as 4 years of age. We thus agree with both Gregoriadis and Tsigilis (2008) and Webb and Neuharth-Pritchett (2011) in that the meaning and interpretation of a dependent relationship may be subject to cultural differences.

### *Gender Invariance*

Although there exists only limited evidence of noninvariance across gender, some speculations can be made as to why girls had a higher mean on the closeness subscale and why Item 4 seemed to function differently for boys and girls.

In Norway 80% to 90% of the preschool teachers are women; some of the explanation may thus be attributable to the gender match between girls and their preschool teachers. It might be that female teachers find it easier to develop a close relationship to girls than boys because they identify more with the ways in which girls interact. It is found in the literature that girls tend to have a more positive and close relationship with their teacher than do boys (Howes et al., 2000; Justice et al., 2008) and that it even might be more important for girls to have such a close relationship (Ewing & Taylor, 2009). There is also evidence that girls are more compatible with the closeness relational quality because of their orientation toward affiliation and intimacy in relationships (Maccoby, 1998). The items in the closeness scale of the STRS do emphasize intimacy, and perhaps Item 4 in particular, "This child is uncomfortable with physical affection or touch from me." Teachers' were somewhat more likely to positively endorse this item for girls (i.e., girls are less often uncomfortable with physical affection or touch). This might be a reflection of Item 4 as an indicator of closeness better suited for girls because of their orientation toward intimacy.

Our study is the first to investigate whether the STRS was equally applicable to boys and girls. Given only limited evidence of noninvariance it is at this point too early to conclude on STRS' invariance status when it comes to gender. Our findings do, however, point to the importance of pursuing this focus in future research.

### *Do the Conflict and Dependency Subscales Measure Separate Constructs?*

Our results partially supported our initial hypotheses on discriminant validity by showing that conflict was more strongly related to aggressive and oppositional defiant behavior in particular and externalizing behavior in general than dependency. These findings are in line with research that has reported a positive association between expressed anger and conflict in preschool children (Justice et al., 2008). Why angry and oppositional preschoolers also are rated as dependent can be explained by the fact that these children may be more immature and are rejected by their peers; consequently, they may turn to their teachers. Teachers may find that the considerable amount of time spent with these children is taxing, and thus, conflicts may arise.

Contrary to our hypotheses, dependency did not show a stronger association to internalizing problems than conflict. This might reflect that internalizing problems are harder to detect in preschoolers and also underreported. An alternative explanation could be that a teacher-child relationship perceived as dependent in preschool is related to children displaying comorbid behavioral problems: both externalizing and internalizing.

One could also reason that children who are overly dependent on their preschool teacher may have an insecure resistant attachment pattern (C status) more often than other children. These

children act in ambivalent ways toward their caregivers by alternating between being clingy and needy and aggressive or accusing. Several studies have supported the connection between a C-status attachment and inhibited, dependent, and withdrawn behaviors (Rubin, Coplan, & Bowker, 2009).

### **Strengths and Limitations**

In spite of various strengths of the current study, which include a large and representative sample of a known community and the use of rigorous methodology in the factorial validation of the STRS, there are some limitations. A possible selection bias cannot be ruled out since 10% of the teachers did not return the forms. However, it is less likely that nonresponding teachers had a conception of the STRS that could alter the factor solution or that the relationships between these teachers' STRS scores and the validation criteria were sufficiently different (thus indicating a strong interaction term) to alter the general findings in this study.

### **General Conclusions and Implications**

On the basis of our findings, we can confirm the validity of a slightly modified three-factor STRS, for preschool samples. The fact that we did not find support for a more parsimonious two-factor model leads us to conclude that the development of an even more conceptually stable and psychometrically solid three-factor model should be continued. With improved discriminant validity the dependency subscale may have the ability to identify preschool children with other types of problems than those related to conflict.

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