**The Bright and the Dark Side of Peer Relationships: Differential Effects of
Relatedness Satisfaction and Frustration at School on Affective Well-Being in
Children's Daily Lives**

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Author Note

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Abstract

Satisfaction and frustration of the basic psychological need for relatedness have been postulated to play a vital role for affective well-being. Yet, this prediction has not been thoroughly tested in school children's everyday lives. In this work, we examined the association between relatedness satisfaction and frustration at school on daily and average positive affect (PA) and negative affect (NA) using ambulatory assessment in three intensive longitudinal studies with children aged 9-12 (total $N = 317$). In Study 1, fourth to sixth graders reported their PA and NA two times daily and their relatedness satisfaction and frustration once a day for two weeks. In Study 2 (Study 3), fourth graders (fifth graders) reported their PA and NA four times daily and their relatedness satisfaction and frustration once a day for four weeks. Across the three studies, relatedness satisfaction and frustration were psychometrically separable and exhibited differential effects such that relatedness satisfaction was significantly associated primarily with PA, and relatedness frustration was significantly associated only with NA at between- and within-person levels. Explaining inter-individual differences suggested that the association between daily relatedness and affective well-being was weaker for generally highly integrated children and stronger for usually rather excluded children.

Keywords: need for relatedness; school context; affective well-being; self-determination theory; experience sampling; within-person

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Social environments supporting an individual's innate and basic psychological needs are crucial for healthy development, growth, and well-being (Deci & Ryan, 2000). Within self-determination theory (SDT), Deci and Ryan (2000) have proposed the *need for relatedness* as one of three basic needs. The need for relatedness is satisfied when a person feels socially included, valued, and as part of a group; it is frustrated when he or she feels socially excluded, rejected, or ostracized. Empirical research has provided support for the claim that both relatedness satisfaction and (lack of) relatedness frustration are essential for well-being (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011a; Chen et al., 2015; Deci & Ryan, 2000; Neubauer & Voss, 2018; see Ng et al., 2012; van den Broeck, Ferris, Chang, & Rosen, 2016, for meta-analyses). Accordingly, recent research indicates that relatedness satisfaction and frustration represent distinct constructs, with relatedness satisfaction being particularly predictive of beneficial outcomes and relatedness frustration being associated primarily with adverse outcomes (Bartholomew et al., 2011b; Bartholomew et al., 2011a; Chen et al., 2015). So far, these findings are mainly based on samples of adults, while corresponding research with children is scarce. Although SDT proposes the need for relatedness to apply to all age groups, this universality claim has not been tested extensively with respect to children's everyday lives so far (Ryan & Deci, 2000a). The present article aims at addressing this gap by presenting three intensive longitudinal studies that allow for the simultaneous examination of within- and between-person effects of relatedness satisfaction and frustration on both positive affect (PA) and negative affect (NA) in children aged 9 to 12.

The Need for Relatedness: Associations With Well-Being

SDT's assumption that the fulfillment of the need for relatedness is an essential predictor for psychological growth and well-being has received considerable support in both cross-sectional studies (Bartholomew et al., 2011a; Chen et al., 2015; Cordeiro, Paixão, Lens, Lacante, & Sheldon, 2016; Gunnell, Crocker, Wilson, Mack, & Zumbo, 2013) as well as daily diary or intensive longitudinal studies (Bartholomew et al., 2011a; Heppner et al., 2008; Martela, Ryan, & Steger, 2018; Neubauer & Voss, 2018; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Ryan, Bernstein, & Brown, 2010). This indicates that individuals reporting higher relatedness fulfillment also tend to report higher well-being and that days with higher relatedness are also days with, for example, more experiences of vitality and PA (Bartholomew et al., 2011a), higher self-esteem (Heppner et al., 2008), or sense of meaningfulness and significance (Martela et al., 2018).

SDT further proposes that relatedness satisfaction and frustration depend on social contexts, in that need-supportive contexts facilitate relatedness satisfaction and thus are related to effective functioning and well-being, whereas need-thwarting environments produce relatedness frustration, leading to psychopathology and ill-being (Ryan & Deci, 2018). Hence, as different contexts are considered to either enhance or actively impair healthy development via distinct motivational trajectories, relatedness satisfaction and frustration should be distinguished theoretically and empirically (Ryan & Deci, 2018). Recent research with adults provides evidence supporting this claim by demonstrating that relatedness satisfaction and relatedness frustration do not represent opposite poles of one dimension, but are psychometrically separable and thus constitute relatively distinct constructs (Bartholomew et al., 2011a; Chen et al., 2015; Haerens, Aelterman, Vansteenkiste, Soenens, & van Petegem, 2015; Sheldon, Abad, & Hinsch, 2011; Sheldon & Gunz, 2009). Hence, relatedness frustration is not equivalent to a mere lack of relatedness satisfaction (i.e.,

not feeling included or valued); it rather refers to an actively thwarted need for relatedness (i.e., feeling socially excluded, ostracized, or rejected; Bartholomew et al., 2011b; Bartholomew et al., 2011a; Deci & Ryan, 2000). Research covering the effects of both relatedness satisfaction and frustration has revealed that relatedness satisfaction was primarily associated with positive outcomes (e.g., PA, vitality, life satisfaction), whereas relatedness frustration was particularly predictive of negative outcomes (e.g., NA, depression, physical or clinical symptoms; Bartholomew et al., 2011a; Chen et al., 2015; Cordeiro et al., 2016; Gunnell et al., 2013; Verstuyf, Vansteenkiste, Soenens, Boone, & Mouratidis, 2013). Such patterns of findings also led Ryan and Deci (2000b) to establish psychological need satisfaction as the “bright” side and need frustration as the “dark” side of human existence.

So far, it remains an open question if the dissociation of the bright and the dark side can also be observed in younger age groups. Can children in middle childhood already distinguish between relatedness frustration and (lack of) relatedness satisfaction? Previous work argues that cognitive limitations in children lead to a unidimensional perception of the world in that, for instance, children cannot integrate emotions of different valence (Harter & Buddin, 1987) until the age of eight, approximately (Griffin, 1992). As cognitive development precedes, children’s perceptions of the world become increasingly complex (Fischer, 1980). Understanding if children in middle childhood can report having felt both socially satisfied and frustrated (i.e., seemingly opposite experiences) on a daily basis provides meaningful insights into whether children at this age have overcome the unidimensional thinking in the social domain.

Research aiming at the explanation of differential effects of relatedness on well-being in adults suggests the existence of distinct processing paths and activation patterns of positive and negative information in the human brain (Jung et al., 2006; Spielberg et al., 2011; Tomarken & Keener, 1998). A better understanding of the interplay of relatedness

satisfaction/frustration and well-/ill-being in middle childhood informs about whether distinct cognitive pathways might already have evolved at this stage.

Research in Children: The Role of Peers at School

For children, one of the most important social environments is provided by the school context (Eccles, 1999). Within SDT, Ryan and Deci (2018) emphasize that schools should be considered as more than “learning factories” (p. 353), but as “pervasive developmental contexts” (p. 353), allowing and requiring children to learn about interpersonal relationships and how they are perceived by others outside the home. Children interact with their peers at school on a regular basis and both positive and negative peer experiences can occur during lessons and recesses. For instance, children might get picked last in a team or get excluded from team decisions, frustrating the need for relatedness; or they might succeed in cooperating with their peers, leading to a satisfied need for relatedness. Thus, classmates represent significant others for children and therefore constitute a source of the satisfaction or frustration of the need for relatedness (Ryan & Deci, 2000a). Middle childhood represents a highly relevant period to study the associations between need fulfillment¹ and outcomes, as during this time, child development is largely determined by meeting basic psychological needs, that is for instance, the need for relatedness (Eccles, 1999). Underlining the special importance of classmates, need fulfillment at school (aggregated across the SDT needs for relatedness, competence, and autonomy) was found to significantly predict PA and NA in third and seventh graders, whereas need fulfillment with friends did not (Véronneau, Koestner, & Abela, 2005). In other analyses, Véronneau et al. (2005) found significant associations of relatedness fulfillment with concurrent and future PA, but not with concurrent or future NA. Emery et al. (2015) showed that relatedness was negatively associated with depressive symptoms in a

¹ In some of the following studies, researchers aggregated across the dimensions of need fulfillment (e.g., with inverse coded items), while in other studies, it was unclear whether the measures assessed need satisfaction only or whether it was aggregated across dimensions. Therefore, we will use the term need fulfillment, referring to a combination of satisfaction and (lack of) frustration.

sample of adolescents (grades eight through eleven), but not in a sample of children (grades four through six). According to the authors, this difference across age groups might be explained by the increasing importance of peers during adolescence. In some of the analyses on need fulfillment, researchers aggregated across the three needs (e.g., Véronneau et al., 2005), or combined items referring to both peers and teachers to a general relatedness scale (e.g., Emery, Toste, & Heath, 2015; Véronneau et al., 2005). However, in their meta-analysis, van den Broeck et al. (2016) concluded that it is inappropriate to compute an average need fulfillment score as each need explained unique variance in the dependent variables and was related differently to diverse outcomes. Fedesco, Bonem, Wang, and Henares (2019) further showed that the two sources of relatedness in the school context (i.e., teachers and peers) should be distinguished, as their analyses revealed them to constitute separable factors. We therefore consider it important to differentiate between relatedness satisfaction and frustration. We decided to focus on peers as a source of relatedness in the present work, because establishing healthy relationships with peers is considered an important developmental task in the examined age range and peers begin to take on heightened significance in children's lives (Eccles, 1999; Erikson, 1968; Rubin, Bukowski, & Parker, 2006). Furthermore, prior research has demonstrated the particular importance of peer experiences in childhood for long-term outcomes such as adult adjustment, psychological health, and well-being (e.g., Bagwell, Newcomb, & Bukowski, 1998; Parker & Asher, 1987).

Within-Person Studies in Children: Day-to-Day Associations Between Relatedness and Well-Being

SDT specifically proposes that “fluctuations in need satisfaction will directly predict fluctuations in well-being” (Deci & Ryan, 2000, p. 243), referring to a within-person association between need satisfaction and well-being. As both affective experiences and social interactions are context-dependent and dynamic, we emphasize the importance to study

them on a state-level, that is, within children over time. This can be accomplished via ambulatory assessment approaches that allow data collection in a natural context in everyday life (Ebner-Priemer, Kubiak, & Pawlik, 2009). Previous research has demonstrated that associations found on the between-person level do not necessarily map onto associations on the within-person level (Molenaar, 2004). In a study comprising daily data collection over four weeks with multiple daily assessments of PA and NA, Schmidt, Dirk, and Schmiedek (2019) showed that on the between-person level, children's relatedness satisfaction was associated with higher PA and lower NA, whereas on the within-person level, it was associated with PA, but not with NA. As this study illustrates, studies explicitly targeting relations on the within-person level are needed to test predictions on within-person processes (Molenaar, 2004). Although research comprising multiple assessments in the field is growing, it is still limited regarding child populations. The study by Schmidt et al. (2019) is limited as they only assessed relatedness satisfaction, but not relatedness frustration. To the best of our knowledge, there is only one study examining the within-person relations among need satisfaction, need frustration, and multiple components of well-being in elementary school children. Based on a data collection over five days, van der Kaap-Deeder, Vansteenkiste, Soenens, and Mabbe (2017) showed that need satisfaction and frustration uniquely contributed to the prediction of both PA and NA on a daily level. Yet, since the authors aggregated across the needs for relatedness, competence, and autonomy, it remains unclear whether the satisfaction and frustration of each need (in particular interest to the present study: the need for relatedness) explained unique variance in the dependent variables.

Further support of the importance of daily relatedness satisfaction and frustration for well-being can be drawn from intensive longitudinal research targeting related constructs. For instance, daily negative peer experiences (e.g., victimization) have been found to be associated with increases in negative affectivity (e.g., Nishina, 2012) and decreases in positive

affectivity (Reavis, Donohue, & Upchurch, 2015). Yet, our literature review revealed only one study assessing both positive and negative peer experiences and positive and negative affectivity simultaneously: Lehman and Repetti (2007) showed daily peer success (e.g., having a good time playing with peers) to predict positive mood, but not anxious mood, whereas peer problems (e.g., getting teased by another kid) were found to have an effect on anxious mood, but not on positive mood.

In the present work, we assessed children's relatedness satisfaction/frustration conceptualized in the framework of SDT. These constructs are related to, but in crucial aspects more encompassing than peer victimization, bullying, or peer acceptance as assessed in previous studies. For instance, relational victimization refers to the experience of behaviors that intentionally aim at harming one's peer relationships or social reputation (e.g., "How often does another kid tell lies about you to make other kids not like you anymore?"; Crick & Grotpeter, 1996). However, children can experience treatment analogous to peer victimization that frustrate relatedness needs even when that treatment is clearly not intentional (e.g., exclusion due to a lack of seats at a table; feeling belittled even when the teaser was clearly just joking). Furthermore, typical peer rejection measures refer to the negative attitude of a whole group towards a child (see Ladd & Troop-Gordon, 2003). However, negative interactions with one peer can be sufficient to thwart the need for relatedness. Moreover, peer rejection and acceptance measures often are implemented by peer nomination procedures (e.g., Ladd, Kochenderfer, & Coleman, 1997). Relatedness satisfaction and frustration, however, refer to subjective evaluations of peer experiences that may not be consistent with peer-reported sociometric status. In the present work, we targeted a construct of relatedness satisfaction/frustration – rooted in SDT (Ryan & Deci, 2018) – that provides a theoretical rationale for why certain interpersonal experiences are associated with personal well-being: Need fulfillment in this framework is considered the explanatory

mechanism linking a range of peer experiences to health-related outcomes (La Guardia & Patrick, 2008; Ryan & Deci, 2018).

Current Research

The present article extends previous research in three major ways. First, while prior research in adults has supported SDT's prediction that the "dark" and "bright" side (Ryan & Deci, 2000b) of need fulfillment should be separated, it is unclear if such relative dissociation between relatedness frustration and relatedness satisfaction can already be observed in middle childhood. In this context, we expand existing research by investigating whether children report a differentiated view on their daily interpersonal experiences or whether they pool them together to "all good" or "all bad". Based on research with adolescents and adults (e.g., Bartholomew et al., 2011a; Chen et al., 2015), we hypothesized that relatedness satisfaction and frustration would be separable psychometrically on both the between- and within-person level and thus represent two potentially correlated, but distinct factors instead of opposite poles of one dimension (*Hypothesis 1*). Second, since previous research with adolescents and adults revealed differential effects of relatedness satisfaction and frustration on positive and negative outcomes, we extended existing research to the population of children by assessing both components of affective well-being (i.e., PA and NA). Building on SDT and prior research in adolescents and adults (e.g., Bartholomew et al., 2011a), we hypothesized relatedness satisfaction to be associated with higher PA, but to be unrelated to NA on the between- (*Hypothesis 2a*) and within-person level (*Hypothesis 2b*). By contrast, we predicted relatedness frustration to be associated with higher NA, but to be unrelated to PA on the between- (*Hypothesis 3a*) and within-person level (*Hypothesis 3b*). Third, we extend previous research by presenting three intensive longitudinal studies across two to four weeks including up to four daily assessments of affective well-being. This approach allowed us to explore whether the effects of relatedness satisfaction and frustration on PA and NA varied across the

day. In an exploratory fashion, we aimed at investigating whether there are meaningful inter-individual differences in the associations between relatedness satisfaction/frustration and affective well-being. All hypotheses were tested in Studies 1-3. Analyses in Study 3 were preregistered after results of Study 1 were known (see <https://osf.io/uywbr>).

Method

Procedure

The data presented in the current work was collected in the SASCHA project (Social and Academic School transition CHAllenges), examining social and academic challenges children face when transitioning from primary to secondary school. The project comprised pilot studies and three main measurement bursts. The largest pilot study is presented as Study 1, Burst 1 is presented as Study 2, and Burst 2 is presented as Study 3 in the current work. In Study 2, fourth graders were examined in Grade 4 before they transitioned to secondary school and in Study 3, children were examined in Grade five right after school transition in their first weeks at the new school. We preregistered Study 3 based on results of the pilot study (i.e., Study 1) and before the start of data collection of Study 2. We focused on data of Study 3 in the preregistration, as we expected a larger number of participants (and therefore higher power) in Study 3 than in Study 2. We will apply all preregistered data preparation and analyses already to data of the first burst (i.e., Study 2). The project was planned as a longitudinal measurement burst study, however, there were only four children participating longitudinally in both Burst 1 (Study 2) and Burst 2 (Study 3). Therefore, we performed control analyses excluding those children who had participated for a second time from the analyses. No child from Study 1 participated in Study 2 or Study 3.

We conducted intensive longitudinal studies with two (Study 1) and four (Studies 2-3) daily assessments over two weeks (Study 1, September 2017) and four weeks (Study 2, April-May 2018; Study 3, September 2018). In all studies, the project was presented by research

assistants in schools and children received letters and flyers containing information on the project. Then, parents and children could voluntarily register for participation by providing written informed consent. In Study 1, there was a 60-minutes pre-test session and in Studies 2-3, there were pre- and post-test sessions of 6 hours in total. The sessions took place in rooms provided by the participating schools. During the pre-test, children got familiar with the smartphones and practiced responding to the questions. Additionally, in Studies 2-3, trait and background measures (e.g., demographics) were obtained, whereas in Study 1, such data was collected within the first daily assessments. All smartphones were specifically prepared and programmed for the present study in that all regular functions of the smartphones (e.g., internet, Wi-Fi, games, setup menu, message, and phone call services) were blocked and our application was the only remaining application that could be accessed. Participating children kept the smartphones for the course of the study. During the weeks of ambulatory assessment, data on affect, relatedness satisfaction and frustration, and several other constructs were collected via smartphones on consecutive school days (for more information see study protocol <https://osf.io/yvfpj/>). In Study 1, there were two assessments each day, one in the mornings before school (6.30 am-9.00 am) and one in the evenings after school (4.00 pm-7.00 pm). In Studies 2-3, there were four daily assessments (morning, late morning, afternoon, evening) that slightly differed in when exactly they were scheduled. The times of assessments in Study 2 (Study 3) were as follows: in the morning before school between 6.45-7.50 am in School 1 and 6.45-8.05 am in School 2 (6.00-7.50 am), in the late morning at school at 9.30 am in School 1 and 10.15 am in School 2 (9.50 am), in the afternoon between 3.00-5.15 pm (3.00-5.15 pm or 4.00-5.45 pm on longer school days), and in the evening between 6.30-8.30 pm. In Study 2, assessment times slightly differed across the two participating schools due to differing times of school beginnings and recesses. Children could start the assessments at any point within the given time windows. The morning session took

approximately 5-10 minutes, while the other sessions took approximately 10-15 minutes. We collected data on children's affect at all assessments and on their relatedness satisfaction and frustration once a day in the evening session. Participation in the study was voluntary and could be terminated anytime without giving reasons. We provided a telephone hotline for all concerns during the study. For their participation, subjects received a reward in form of a gift coupon. The SASCHA project was approved by the ethics committee of the German Psychological Society (DGPs; protocol number FS 092013, title: Dynamische Prozesse im kindlichen Erleben des Schulübergangs auf die weiterführende Schule).

Participants

Study 1. One-hundred and nineteen children (63 boys) from fourth to sixth Grade (9-12 years, $M = 10.42$ years, $SD = 0.83$) at an urban neighborhood elementary school and a secondary school (Gymnasium) in Frankfurt am Main, Germany, participated. Nineteen children (16%) attended Grade four, 54 children (45.4%) attended Grade five, and 46 children (38.7%) attended Grade six. German (alone or in combination with another language) was the native language of 78 children (65.6%), whereas 40 children (33.6%) had another native language than German (1 missing). The percentages of the current employment status of mothers/fathers were as follows: no employment: 18.5/2.5; part-time employed: 55.5/6.7; full-time employed: 23.5/82.4; no information: 2.5/8.4.

Study 2. Ninety children (41 boys) from Grade four of two elementary schools in a large German city participated in the study. The children were 9 to 11 years old ($M = 9.83$ years, $SD = 0.50$). Forty-four children (48.9%) attended School 1 and 46 children (51.1%) attended School 2. Participation rates were 64.7% at School 1 and 76.7% at School 2. German (alone or in combination with another language) was the native language of 68 children (75.6%), whereas 13 children (14.4%) had another native language than German (9 missing). The percentages for the current employment status of mothers/fathers were as

follows: no employment: 17.8/4.4; part-time employed: 64.4/3.3; full-time employed: 10.0/80.0; no information: 7.8/12.2.

Study 3. One-hundred and eight children (48 boys) from Grade five of a secondary school (Gymnasium) in a large German city participated in the study (participation rate: 60%). The children were 9 to 11 years old ($M = 10.11$ years, $SD = 0.44$). German (alone or in combination with another language) was the native language of 90 children (83.3%), whereas 18 children (16.7%) had another native language than German. The percentages for the current employment status of mothers/fathers were as follows: no employment: 19.4/2.8; part-time employed: 63.9/3.7; full-time employed: 15.7/93.5; no information: 0.9/0.

Daily Measures

All items were answered using a 5-point Likert scale ranging from 1 (“not at all true”) to 5 (“completely true”). The amount of data available, descriptive statistics, and reliabilities of affect and relatedness are shown in Table 1. The wording of each item as well as the original German items are presented in the Supplemental Material S1.

Affect. The scale we used is a short version of an affect scale developed for measuring affective states in elementary schoolchildren and was used in previous studies (e.g., Leonhardt, Könen, Dirk, & Schmiedek, 2016; Schmidt et al., 2019). In all analyses, momentary PA was operationalized as the mean response across the three PA items, and momentary NA was operationalized as the mean response across the three NA items. In Studies 2-3, one item was added to the NA scale (“Right now, I feel sad.”). This item was added to broaden the content of negative affectivity with a marker of low arousal NA. In Studies 2-3, we computed variables reflecting children’s PA and NA, respectively, across the day (means of PA and NA across school, afternoon, and evening assessments, excluding morning assessments) when at least one of the data points was available.

Relatedness satisfaction and frustration. Each evening, children reported on their perceived relatedness satisfaction and frustration at school on that particular day. The four items assessing relatedness satisfaction (e.g., “Today, I got along well with the kids in my class”) were used in a previous study (see Schmidt et al., 2019). The four items assessing relatedness frustration were developed for the present study. The items were developed to be brief and easy to understand for children (e.g., “Today, someone in my class picked on me”).

Plan of Analyses

Data of the present study comprised a multilevel structure with repeated measures (Level 1) being nested within children (Level 2). Therefore, we used a multilevel approach to analyze the effects of relatedness satisfaction and frustration on PA and NA, respectively. We estimated the multilevel models (MLMs) using the nlme package (Pinheiro, Bates, DebRoy, Sakar, & R Core Team, 2019) of the statistical software R for Windows, version 3.5.1 (R Core Team, 2017) and maximum likelihood estimation. We applied a conventional alpha level of .05 to all tests. Significance of fixed effects was tested with the package’s default estimation of degrees of freedom. Random effects were allowed to co-vary freely (i.e., unstructured G-matrix) and their significance was evaluated using likelihood ratio tests comparing the fit of the model including the random variance to the fit of a model without the random variance. Between- and within-person effects of relatedness satisfaction and frustration on affect were evaluated while allowing intercept and slope to vary between subjects. We computed individual person-means of relatedness satisfaction and frustration as the respective average values aggregated over all measurement points of a child. We centered these person-means on the grand mean, that is, the mean of all daily observations, and entered these variables as Level 2 predictors. As Level 1 predictors, daily relatedness satisfaction and frustration responses were centered on the computed individual person-means. This procedure allowed for the examination of both within-person and between-person effects of

relatedness satisfaction and frustration on PA and NA. The formal model description for predicting child j 's PA (measured in the evening in Study 1 and referring to a daily average in Studies 2-3) of day d is:

Level 1:

$$PA_{dj} = \beta_{0j} + \beta_{1j}(\text{RELSAT}_{dj} - \text{RELSAT}_{.j}) + \beta_{2j}(\text{RELFUS}_{dj} - \text{RELFUS}_{.j}) + \varepsilon_{dj} \quad (1)$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{RELSAT}_{.j} - \text{RELSAT}_{..}) + \gamma_{02}(\text{RELFUS}_{.j} - \text{RELFUS}_{..}) + u_{0j} \quad (2)$$

$$\beta_{1j} = \gamma_{10} + u_{1j} \quad (3)$$

$$\beta_{2j} = \gamma_{20} + u_{2j} \quad (4)$$

where j = child, d = day, RELSAT = relatedness satisfaction, RELFUS = relatedness frustration and subscript .. indicating the grand mean.

Results

Descriptive Statistics and Preliminary Analyses

Table 1 contains information on the amount of data available, descriptive statistics, and reliabilities for PA and NA, and relatedness satisfaction and frustration. Item-level descriptive statistics for relatedness satisfaction and frustration are presented in the Supplemental Material S2. Reliabilities were estimated using McDonald's Omega (see Geldhof, Preacher, & Zyphur, 2014). The average amount of available data of the constructs of interest was 88.4% in Study 1, 71.3% in Study 2, and 78.9% in Study 3. Missing data in studies with repeated measures designs are typical and result from illnesses, exams, other obligations, or technical issues, for instance. The amount of available data was above (Studies 1 and 3) or slightly below (Study 2) the average compliance rate (76%) of comparable ambulatory assessment studies with children and adolescents (Heron, Everhart, McHale, & Smyth, 2017). Analyses of correlations between missing data proportions and study variables as well as demographics revealed that, in all studies, children with higher levels of

relatedness frustration had more missing data. Furthermore, in Studies 1 and 3, children with higher levels of NA had more missing data. In addition, in Study 1, children with lower relatedness satisfaction and younger children had more missing data (see Supplemental Material S3, for more information). On a daily level, multilevel logistic regression analyses controlling for fixed time trends revealed no associations between the probability of missing values in the evening assessment and (morning or daily) study variables in either study (see Supplemental Material S4, for more information).

Correlations between PA and NA on the within- and between-person level in all studies are presented in Table 2 and showed that PA and NA were negatively correlated on the within-person level (ranging from $r = -.40$ to $r = -.15$), whereas they appeared to be less consistently correlated on the between-person level (ranging from $r = -.54$ to $r = .11$). We performed trend analyses in which PA, NA, relatedness satisfaction or relatedness frustration, respectively, were predicted by a fixed and random effect of time (i.e., study days). Detailed information on time trends can be found in the Supplemental Material S5. In Study 1, only NA increased over the course of the study. In Studies 2 and 3, children's NA and relatedness frustration increased, whereas their PA and relatedness satisfaction decreased. Furthermore, in all studies, children differed from each other in all these trends. To account for such long-term trends that might result from a decline in motivation to participate in the study, control analyses were performed in which we accounted for fixed and random trends of time.

Hypothesis 1: Factor structure of relatedness satisfaction and relatedness frustration

We performed multilevel confirmatory factor analyses (MCFAs) using Mplus Version 8 (Muthén & Muthén, 1998-2017) to test whether relatedness satisfaction and relatedness frustration could be separated on the between- and within-person level. We performed two MCFAs, a one-factor model with all eight manifest variables loading on one relatedness factor and a two-factor model with two pairs of four items representing a relatedness

satisfaction and a relatedness frustration factor. The two nested models were compared with likelihood ratio tests. We used the robust maximum likelihood estimator (MLR; the default for multilevel CFA in Mplus), so the χ^2 -difference test needed to be adjusted by a scaling correction factor (Yuan & Bentler, 2000). Model fit was further assessed applying criteria evaluated by Hu and Bentler (1999). For all studies, model fit information of both models is presented in Table 3. In Studies 1-2, the two-factor model representing relatedness satisfaction and relatedness frustration fitted the data better than the one-factor model representing relatedness as a single dimension (Study 1: $\chi^2(2) = 460.91, p < .001$; Study 2: $\chi^2(2) = 130.63, p < .001$), indicating that relatedness satisfaction and frustration represented two distinct dimensions. In Study 3, the likelihood ratio test revealed an implausible χ^2 -value (< 0), most likely due to estimation problems. Therefore, we compared fit indices of both models, indicating that the one-factor model had an unacceptable model fit, whereas the two-factor model had a good model fit². Hence, we concluded that the two-factor model fitted the data better than a one-factor model in Study 3 as well.

On the between-person level, relatedness satisfaction and frustration were not significantly correlated in either study (Study 1: $r = -.22, p = .08$; Study 2: $r = .14, p = .29$; Study 3: $r = -.07, p = .54$). On the within-person level, the factors were weakly correlated in varying directions (Study 1: $r = -.18, p = .01$; Study 2: $r = .14, p = .002$; Study 3: $r = .06, p = .42$). All factor loadings were statistically significant (see Supplemental Material S6).

Hypotheses 2 and 3: Associations between relatedness and affect

Table 4 shows the prediction of PA and NA by relatedness satisfaction and frustration in all studies. Across studies, there were significant positive effects of relatedness satisfaction on PA on the between- and within-person level, but there were no significant effects of

² When refitting the models using maximum likelihood estimation, the likelihood ratio test indicated that the more complex two-factor model fitted the data better than the one-factor model, $\chi^2(2) = 2780.68, p < .001$.

relatedness frustration on PA on the between- or within-person level. Regarding NA, there were significant negative effects of relatedness frustration on the between- and within-person level in all studies. In Studies 1-2, there were no significant effects of relatedness satisfaction on NA on the between- or within-person level. However, in Study 3, there was a significant negative within-person effect of relatedness satisfaction on NA.

Examining random effects revealed that in Study 1, children significantly differed from each other only in the strength of the within-person effect of relatedness frustration on NA. In Study 2, children differed in the within-person effects of relatedness satisfaction on both PA and NA, and in the association between relatedness frustration and NA. In Study 3, children significantly varied in the strength of all four within-person associations. Figure 1 schematically summarizes the results for Hypotheses 2 and 3 across Studies 1-3.

Additional Analyses Concerning Hypotheses 2 and 3

Order Effects. Data of Study 1 allowed for an examination of order effects in the survey. Half of the participants received a fixed item order (first affect items, then other constructs and later relatedness), whereas the second half responded to the constructs in a randomized order (different order of constructs in each of the 10 evening sessions). Fixed versus random order of constructs was randomized on the between-person level. We entered this between-person factor (order fixed vs. randomized) as a moderator variable in the MLMs predicting PA or NA by relatedness satisfaction and frustration. None of the four interaction terms was statistically significant ($p > .05$), suggesting that there were no meaningful order effects.

Sensitivity Analyses. We performed several sensitivity analyses exploring the robustness of our findings: We examined whether the results remained unaltered if we, first, examine PA and NA simultaneously, second control for time trends, third control for morning affect, fourth exclude the fourth NA-item (Studies 2-3), or fifth exclude the four

longitudinal children in Study 3. The detailed results on these analyses are presented in Supplemental Materials S7-S9.

First, as an alternative analysis that also takes into account the relationship between PA and NA, we estimated multilevel structural equation models in which both PA and NA were entered as dependent variables simultaneously. In Studies 1 and 3, the pattern of significant findings and corresponding conclusions did not change. In Study 2, the within-person effect of relatedness satisfaction on NA became statistically significant ($b = -0.06$, $SE = 0.03$, $p = .03$), indicating that, when assessing relations to PA and NA simultaneously, days with higher perceived inclusion than usually were accompanied by lower NA. Second, to control time trends in the dependent variables, we added a fixed and random linear time trend of the variable coding the study day. There were no changes in the pattern of significant fixed or random effects in Study 1. In Study 2, the between-person effect of relatedness satisfaction on NA became significant ($b = -0.11$, $SE = 0.05$, $p = .03$). In Study 3, the random effect of relatedness frustration on PA was not significant anymore. Third, controlling for morning PA or NA, respectively (i.e., PA or NA assessed in the mornings before school, centered on their respective person means of the morning session), there were no changes in the pattern of significant fixed or random effects in either study. Likewise, excluding the fourth item (“sad”) forming the NA-scale in Studies 2-3 did not yield any changes in significances of fixed or random effects in either study (see Supplemental Material S10). Fifth, four of the 108 children in Study 3 had already participated in Study 2. As it is possible that retesting a certain proportion of the participants could influence our results, we performed preregistered sensitivity analyses excluding these four children. There were no changes in the pattern of significant fixed or random effects when excluding these four children from the sample.

Summing up, several sensitivity analyses did not substantially alter our results, indicating robustness of the present findings: relatedness satisfaction predicted PA, and relatedness frustration predicted NA.

Changes of Effects Across the Day. In Studies 2-3, we examined whether the effects of relatedness satisfaction and frustration on PA and NA varied depending on the time of day (i.e., at school, after school in the afternoons, or in the evenings before bedtime). For this purpose, we added an interaction term of daily relatedness satisfaction and daily relatedness frustration, respectively, with the time of day (coded as a factor with affect assessed at school serving as the reference). For PA, a model comprising the interaction fitted significantly better than a model including only main effects in both studies (Study 2: $\chi^2(4) = 17.41, p = .002$; Study 3: $\chi^2(4) = 25.06, p < .001$), indicating that the effects of relatedness satisfaction and frustration on PA varied across the day. Interaction effects showed that the significant positive effect of relatedness satisfaction on PA in the evening was stronger than on PA at school (Study 2: $b = 0.11, p = .01$; Study 3: $b = 0.14, p < .001$). Furthermore, the effect of relatedness frustration on PA in the evening differed from the respective effect on PA at school (Study 2: $b = 0.08, p = .03$; Study 3: $b = 0.08, p = .01$). The main effect of relatedness satisfaction was statistically significant (Study 2: $b = 0.29, p < .001$; Study 3: $b = 0.25, p < .001$) and the effect of relatedness frustration was not (Study 2: $b = -0.06, p = .05$; Study 3: $b = -0.05, p = .08$). Follow-up analyses using a recoded time variable (with assessments after school or in the evening as reference category, respectively) showed that relatedness satisfaction predicted PA after school (Study 2: $b = 0.29, p < .001$; Study 3: $b = 0.29, p < .001$) and in the evening (Study 2: $b = 0.40, p < .001$; Study 3: $b = 0.40, p < .001$), whereas relatedness frustration was unrelated to PA after school (Study 2: $b = -0.02, p = .61$; Study 3: $b = -0.01, p = .74$) and in the evening (Study 2: $b = 0.02, p = .54$; Study 3: $b = 0.03, p = .30$).

We conducted the same analyses for NA. In Study 2, a model including the interaction with time of day was not significantly better than a model including only a fixed effect of time of day ($\chi^2(4) = 8.65, p = .07$), whereas in Study 3, it was significantly better ($\chi^2(4) = 69.72, p < .001$). Interaction effects in Study 3 showed differences in the effect of relatedness satisfaction on NA in the evening (vs. at school), $b = 0.07, p = .045$, and differences in the effects of relatedness frustration on NA in the evening (vs. at school), $b = 0.24, p < .001$, and after school, $b = 0.10, p = .001$. Main effects of both relatedness satisfaction and frustration remained significant in this model (satisfaction: $b = -0.15, p < .001$; frustration: $b = 0.12, p < .001$). Main effects of relatedness frustration remained significant when changing the reference time point. The main effect of relatedness satisfaction remained significant when changing the reference time point to after school NA, but was insignificant when changing the reference time point to evening NA.

Altogether, our analyses revealed that the size of the effects of relatedness satisfaction and frustration on PA and NA was not constant across the day; however, the overall patterns of effects were comparable when predicting school, afternoon, or evening affect.

Studies 1-3: Exploratory Analyses

To maximize statistical power, we performed moderator analyses with the combined sample across the three studies presented in the current article. The total sample size was $N = 317$ (152 boys). We tested for measurement invariance across the three samples. Findings (see Supplementary Material S11, for details) suggested that the assumption of strong (but not strict) measurement invariance across the three samples was tenable.

We investigated whether a child's overall level of relatedness satisfaction or frustration (aggregated across all repeated measures) moderated the effect of daily relatedness satisfaction or frustration on daily PA or NA, respectively. Two MLMs were performed with PA or NA as dependent variables, respectively, and including the cross-level interaction

between the child-level of relatedness satisfaction and daily perceived relatedness satisfaction as well as the cross-level interaction between the child-level of relatedness frustration and daily perceived relatedness frustration. Regarding PA, the interaction between child-level relatedness satisfaction and daily relatedness satisfaction emerged as a significant negative predictor ($b = -0.17$, $SE = 0.03$, $p < .001$), meaning that children who on average felt well-integrated showed a weaker link between daily relatedness satisfaction and PA than children who did not feel well-integrated (see Figure 2, Panel a). Simple slopes analyses indicated that the association between daily relatedness satisfaction and PA was positive and significant at a broad range of levels (from $-1 SD$ to $+1 SD$) of average relatedness satisfaction (all $ps < .001$). Regarding NA, the interaction between child-level relatedness frustration and daily relatedness frustration was a significant positive predictor ($b = 0.12$, $SE = 0.03$, $p < .001$), indicating that children who on average felt relatively excluded displayed a stronger link between daily relatedness frustration and NA (see Figure 2, Panel b). Simple slopes analyses indicated that the association between daily relatedness frustration and NA was positive and significant at a broad range of levels (from $-1 SD$ to $+1 SD$) of average relatedness frustration (all $ps < .001$).

Discussion

In the present work, we investigated the associations between children's experiences of relatedness and their affective well-being in three intensive longitudinal studies. Relatedness fulfillment emerged as a two-dimensional construct with relatedness satisfaction and frustration being separable in schoolchildren as young as 9 years of age. Both dimensions displayed differential associations with affective well-being on the between- and within-person level. We will first discuss findings on the measurement structure and differential effects of relatedness satisfaction and frustration. Then, we will elaborate on inter-individual differences in these associations.

Measurement Structure

Across the three studies presented in the current article, we found relatedness satisfaction and frustration to form two distinct dimensions in children and to thus not refer to opposite ends of a spectrum (*Hypothesis 1*). On the between-person level, the two factors were not significantly correlated in all three studies. On the within-person level, the correlations between these two dimensions were weak and in an inconsistent direction. The factors were weakly correlated in Study 1 ($r = -.18$) and Study 2 ($r = .14$), whereas they were not significantly correlated in Study 3 within persons. Taken together, these results suggest that relatedness satisfaction and frustration form weakly related, but distinct dimensions. Hence, when children felt included and liked at school, this did not automatically preclude them from feeling excluded or picked on. At school, children typically interact with several peers, providing the possibility to gather positive experiences with some peers and negative experiences with other peers at the same day. This psychometric separation replicates findings of previous studies with older participants (Bartholomew et al., 2011a; Chen et al., 2015; Haerens et al., 2015; Sheldon et al., 2011; Sheldon & Gunz, 2009) and extends them to children as young as 9 years of age. This pattern of findings suggests that children in this age range do not perceive their social world in a unidimensional way, lumping social experiences together as “all good” or “all bad” on an everyday level (Fischer, 1980; Griffin, 1992), but are able to report their daily peer experiences at school in a differentiated way.

Differential Effects Between Relatedness and Affective Well-Being

Examining the associations of relatedness satisfaction and frustration with affective well-being, we found support for differential effects of relatedness satisfaction and frustration on affective well-being on the between- and within-person level. On the between-person level, we found across all three studies, that relatedness satisfaction was only significantly associated with PA, but not with NA (*Hypothesis 2a*), and that relatedness frustration was

only significantly linked to NA, but not to PA (*Hypothesis 3a*). Thus, we found that children who got along well with their classmates and who felt liked by them, on average, across all repeated measures, experienced more happiness and contentment. Similarly, children who fought with their classmates and felt picked on, on average experienced more unhappiness, sadness, and anxiety. These between-person results replicate previous findings drawn from adolescents and adult samples (Bartholomew et al., 2011a; Chen et al., 2015; Cordeiro et al., 2016; Gunnell et al., 2013). Furthermore, they fit previous studies with children, as Emery et al. (2015) found relatedness fulfillment to be unrelated to depressive symptoms in children. Examining third and seventh graders, Véronneau et al. (2005) did not find an effect of relatedness fulfillment on NA as well.

On the within-person level, we found across all three studies that relatedness frustration significantly predicted NA, but not PA. This means that on days when children felt more excluded than normally or when they fought more with a peer, they also felt more unhappy, sad, and anxious in the evening (Study 1) or throughout the day (Studies 2-3). Across all studies, we found that relatedness satisfaction significantly predicted PA on the within-person level and in Studies 1-2, relatedness satisfaction did not consistently predict NA (*Hypothesis 3b*); however, in Study 3, there was a significant within-person effect of relatedness satisfaction on NA. Thus, we consistently found that on days when children felt more related to their peers than usually, when they felt more liked, and enjoyed playing with classmates more than usually, they also felt happier and more content in the evening (Study 1) or throughout the day (Studies 2-3). The additional effect in Study 3 was not expected, but went into a reasonable direction: on days, when children felt more related to their peers and felt like children paid more attention to them than usually, they also felt less unhappy, less sad, and less anxious. Potentially, this effect was only significant in the main analyses in Study 3 (in addition to some sensitivity analyses in Studies 1 and 2) because this study

provided the largest statistical power (largest number of available data points). This indicates that feeling related and included might be associated with lower NA, but not as robustly as feeling excluded. At this point, we want to clarify that we do not argue that relatedness frustration is unrelated to positive outcomes and relatedness satisfaction is irrelevant for negative outcomes. Rather, we believe that relatedness satisfaction is linked more strongly to the experience of positive affectivity, whereas relatedness frustration is related more strongly to the experience of negative affectivity (see also van den Broeck et al., 2016).

In the study by van der Kaap-Deeder et al. (2017), need satisfaction and need frustration were each found to be associated with PA and NA on a daily basis, whereas we primarily found differential effects. We hasten to add though, that comparing the present findings to the one reported by van der Kaap-Deeder et al. (2017) is difficult, since these authors aggregated across the three SDT needs, whereas we specifically targeted the need for relatedness only. Schmidt et al. (2019) also found peer relatedness to be linked to PA, but not to NA on a within-person level. In that study, experiences of direct social exclusion or rejection were not assessed, which might explain why only effects on PA, but not NA were found. Going beyond the SDT literature and focusing more on the educational context, we found one intensive longitudinal study assessing both positive and negative peer experiences and positive and negative outcomes: Lehman and Repetti (2007) showed that peer success was associated with positive mood, but not with anxious mood, whereas they found peer problems to predict anxious mood, but not positive mood. We found a similar pattern and extended these findings to a broader measure of negative affectivity and focusing on need satisfaction and need frustration according to SDT. Integrating our findings of the psychometric separation of relatedness satisfaction and frustration and the differential effects on affective well-being suggests that, already by middle childhood, distinct processing

pathways of positive and negative information might have evolved in the brain (Jung et al., 2006; Spielberg et al., 2011; Tomarken & Keener, 1998).

In the present studies, between- and within-person findings mainly revealed the same pattern of significant effects. However, the convergence of findings on both levels cannot be assumed, but needs to be tested empirically (Molenaar, 2004). Conceptually, it is possible that the findings differ from each other: Children who generally have lots of friends at school (or who generally get excluded a lot) might report generally high (low) well-being (between-person association), but children's daily ups and downs of social experiences might not necessarily be related to their daily affect (within-person association). Furthermore, an examination of processes on the within-person level is needed in order to gain knowledge on whether children differ in the strength (and direction) of within-person associations. We therefore examined the associations of relatedness fulfillment and affective well-being on both the between-person level and the within-person level and found more commonalities than differences across these two levels of analyses in the present research setting.

Inter-individual Differences: Satiation and Sensitization?

Across all studies, we found significant random effects, with Study 3 revealing all four random effects to be significant. As Study 3 had the highest statistical power due to the largest number of available data points (four assessments per day across four weeks in combination with high compliance), insignificant random effects in Studies 1-2 might be a result of lower power. Random effects in the present context imply that children differ from each other in how strongly relatedness satisfaction and frustration were linked to PA and NA, respectively. Notably, inter-individual differences in the effect of need fulfillment on affective outcomes are a controversial issue in SDT: given its universality claim, need fulfillment should have positive outcomes for all individuals. However, inter-individual differences in these positive effects might be rather a matter of quantity than quality, meaning

that the effects of need satisfaction (frustration) should be positive (negative) for virtually all individuals, but to different degrees (Neubauer, Lerche, & Voss, 2018; Ryan, Soenens, & Vansteenkiste, 2019). This reasoning is in line with the size of the random effects we obtained in the present work: In all cases, the standard deviations of the random effects (= the square roots of the random variances reported in Table 4) were around the same size as the absolute values of the corresponding fixed effects. This indicates – assuming a normal distribution of the random effects – that the effects obtained were expected to be in the direction postulated by SDT for 84% (or more) of all children.

We explored whether inter-individual differences in the everyday effects of perceived relatedness satisfaction on PA or NA and of perceived relatedness frustration on PA or NA depended on the overall level of relatedness satisfaction or relatedness frustration. The emerged pattern of findings might be explained by satiation and sensitization effects: On the one hand, there were children who can be described as socially satiated, as they usually experienced a high level of social connectedness and/or a low level of social exclusion. For these children, daily experiences of happiness (unhappiness) were only weakly linked to their social inclusion (exclusion) on that particular day, as they had already reached an average satiated level of peer relatedness. This pattern resembles a satiation effect, which according to Baumeister and Leary (1995) is a core defining principle of basic psychological needs. On the other hand, there were children who can be described as social sensitizers, as they usually experienced a low level of social connectedness and/or a high level of social exclusion. For these children, daily experiences of happiness (unhappiness) were strongly linked to social inclusion (exclusion) on that particular day, as they were already sensitized towards relevant social information. This implies that children with trait-like predispositions to low relatedness satisfaction or high relatedness frustration were more reactive on days when their relatedness needs were not met. This pattern resembles the sensitization effect described in the context of

depression (see Morris, Ciesla, & Garber, 2010; Rudolph & Flynn, 2007). From a developmental point, these findings indicate that children who regularly feel socially excluded or teased by peers at school might be at risk for developing maladaptive patterns such as depressive symptoms (Wichers, 2014). However, supporting the universality claim of the SDT, our findings showed that relatedness satisfaction was linked to PA for virtually all levels of average relatedness satisfaction and that relatedness frustration was linked to NA for virtually all levels of average relatedness frustration (see Figure 2). Thus, weaker or stronger associations were a matter of degree, not of the presence or direction of the associations.

Limitations and Further Research

The present research is limited in several ways. First, directions for the causality of effects cannot be inferred. This means that we cannot conclude, for instance, whether children felt good and content because they had a good time with their peers at school or whether they were in a good mood and therefore either got included more strongly by their classmates or intended to include themselves more at school.

Second, we assessed relatedness satisfaction and frustration in the evenings although they referred to the school context. Assessing these constructs at the end of the school day might have decreased potential memory biases; however, practical study implementation reasons hindered us to schedule such a session (e.g., schools not agreeing to participate in case there were two school sessions). Examining differences in the effects of relatedness on affect across the day in Studies 2 and 3, we found that the effect of relatedness satisfaction on PA was stronger when predicting evening PA than school PA. In Study 3, we found the effects of relatedness frustration on NA to be stronger for evening NA and for afternoon NA than for school NA. As the school session took place between 9.30 and 10.10 am, it is possible that many of the peer interactions that children reported on in the evenings took place after 10.10 am. Then, children's evening affect would be related to peer interactions

during the whole school day, while school affect could only be associated with interactions having occurred latest by 10.10 am. This might explain why associations between relatedness and affect tended to be stronger for evening affect than for school affect. Another explanation for stronger effects in the evening might be that relatedness and affect influenced each other in a reciprocal manner. For instance, Lehman and Repetti (2007) demonstrated that school events affected children's mood, which, in turn, influenced their social interactions with parents in the afternoons. However, in a reversed pattern, the effect of relatedness satisfaction on NA was weaker when predicting evening NA than school NA in Study 3. Further research with even more fine-grained assessment times is needed to clarify the temporal dynamics and possible reciprocal influences of peer relatedness and affective well-being in children. Such studies would allow for investigating whether relatedness satisfaction might be associated with NA on a temporally more proximal level (e.g., by assessing them simultaneously within the school context).

Third, due to the measurement-intensive design employed in our studies, the measures of relatedness satisfaction/frustration were not comprehensive of the full range of events that could impact the fulfillment of relatedness needs. Therefore, future studies might include a broader set of peer experiences. Furthermore, we focused on children's relatedness to classmates. Although we assume classmates to represent significant others according to SDT (Ryan & Deci, 2000a) and to detrimentally shape children's development, it would have been interesting to also consider children's relatedness to friends encountered in the afternoons in a sports team, for instance. Related to that, it would be worth investigating children's relatedness to teachers, which play a crucial role in children's daily school life as well (see van der Kaap-Deeder et al., 2017).

Fourth, we focused on one of three needs within SDT. Future studies should include all three needs and examine the relative importance for well-being as well as potential

interaction effects. It might be possible that children can compensate (at least in the short term) for the frustration of one need by satisfying another need.

Finally, the present results are based on a convenience sample that might not be representative of the whole population of 9 to 12-year-olds in Germany (let alone in other cultures). More heterogeneous and representative samples would be needed to establish the generalizability of the present findings.

Implications and Conclusion

The three studies presented in the current work illustrate that both experiences of social inclusion and social exclusion at school are important for children's daily and average affective well-being. We found differential effects, with feeling integrated and liked being particularly predictive of positive affective states and feeling excluded and teased to be primarily linked to negative affective states. These findings implicate that interventions aiming at the initiation of change in either outcome (i.e., well- or ill-being) needs to target the corresponding antecedent (i.e., relatedness satisfaction and frustration). Within the educational context, our findings implicate that it is especially relevant for teachers to be sensitive to the social situation in their classes. Of course, it is important to try to prevent children from experiencing interpersonal interactions that might lead to a frustration of the need for relatedness, which, as the "dark" path, provokes ill-being and psychopathology. However, the present studies also show that there is potential for a "bright" path enabling healthy child development by the enhancement of social inclusion and thus well-being (Ryan & Deci, 2000b). Notably, these two paths seem to operate independently already in middle childhood. In this context, children who feel either little included or highly excluded should be cared for in particular, as they might be especially vulnerable to health-related consequences of social experiences.

We found evidence for a satiation/sensitization effect that might explain inter-individual differences in the association between relatedness and affective well-being: this link was weaker for usually well integrated children (satiation), whereas it was stronger for generally excluded children (sensitization). Our findings highlight (a) the relevance of studying processes within children over time; (b) the importance of differentiating between relatedness satisfaction and frustration as well as to include both positive and negative outcomes; and (c) the role of peer relationships at school for children's well-being across the day, underlining the school context as an important environment facilitating or undermining healthy child development.

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Tables and Figures

Table 1

Descriptive Statistics of Positive Affect, Negative Affect, Relatedness Satisfaction, and Relatedness Frustration in Studies 1-3

Variable	Session	% of available data	No. of available observations	<i>M</i> (<i>SD</i>)	<i>M</i> <i>ISD</i> (<i>SD</i>)	ICC	ω within/between
Study 1							
Positive affect	Morning	91.9	1094	3.55 (1.17)	0.78 (0.34)	.48	.74/.93
	Evening	86.7	1032	3.77 (1.15)	0.84 (0.40)	.36	.71/.95
Negative affect	Morning	91.8	1092	1.71 (0.92)	0.64 (0.40)	.35	.73/.96
	Evening	86.7	1032	1.72 (1.01)	0.70 (0.42)	.34	.60/.95
Relatedness satisfaction	Evening	86.3	1027	3.95 (0.98)	0.67 (0.34)	.43	.71/.89
Relatedness frustration	Evening	86.7	1032	1.75 (1.09)	0.73 (0.47)	.38	.79/.97
Study 2							
Positive affect	Morning	73.7	1194	3.89 (1.27)	0.81 (0.45)	.50	.75/.96
	School	74.8	1245	4.11 (1.18)	0.73 (0.47)	.47	.71/.96
	Afternoon	68.4	1139	3.91 (1.29)	0.85 (0.49)	.44	.76/.96
	Evening	69.5	1156	3.88 (1.33)	0.96 (0.49)	.37	.79/.98
	Mean across school, afternoon, and evening	86.2	1435	3.96 (1.15)	0.67 (0.36)	.55	.80/.97
Negative affect	Morning	73.9	1197	1.71 (1.12)	0.71 (0.50)	.39	.83/.99
	School	74.8	1245	1.77 (1.20)	0.79 (0.52)	.41	.84/.997

	Afternoon	68.4	1139	1.85 (1.26)	0.86 (0.56)	.36	.86/.99
	Evening	70.0	1164	1.87 (1.26)	0.88 (0.57)	.35	.87/.99
	Mean across school, afternoon, and evening	86.3	1436	1.86 (1.14)	0.72 (0.45)	.48	.90/.997
Relatedness satisfaction	Evening	69.8	1162	3.84 (1.29)	0.85 (0.51)	.41	.86/.94
Relatedness frustration	Evening	69.6	1158	2.07 (1.39)	0.93 (0.56)	.43	.87/.99
Study 3							
Positive affect	Morning	85.0	1837	3.86 (1.21)	0.82 (0.44)	.44	.77/.97
	School	86.8	1875	3.97 (1.18)	0.80 (0.43)	.42	.77/.97
	Afternoon	75.9	1640	3.85 (1.23)	0.90 (0.43)	.36	.76/.97
	Evening	77.7	1679	3.92 (1.22)	0.87 (0.44)	.38	.78/.97
	Mean across school, afternoon, and evening	92.7	2003	3.90 (1.06)	0.69 (0.35)	.50	.83/.97
Negative affect	Morning	85.5	1846	1.84 (1.21)	0.80 (0.51)	.42	.85/.99
	School	86.8	1874	1.91 (1.21)	0.82 (0.45)	.41	.83/.99
	Afternoon	76.2	1645	2.00 (1.28)	0.92 (0.48)	.37	.85/.995
	Evening	78.3	1691	1.95 (1.26)	0.88 (0.51)	.40	.86/.99
	Mean across school, afternoon, and evening	92.8	2004	1.99 (1.11)	0.70 (0.38)	.50	.89/.99
Relatedness satisfaction	Evening	78.2	1689	3.96 (1.16)	0.75 (0.46)	.45	.83/.97
Relatedness frustration	Evening	78.5	1695	2.09 (1.37)	0.95 (0.51)	.43	.90/.99

Note. Study 1: $N = 119$, a maximum number of 1190 observations could have been attained per session; Study 2: $N = 90$, max. 1620 observations for the morning session and 1664 observations for all other sessions; Study 3: $N = 108$, max. 2160 observations. Note that in Study 2 there was a lower max. number of observations for the morning session, because for some children, the first day of data collection started with the school session. ICC = intraclass correlation (the proportion of between-person variance to total variance); M ISD = mean intraindividual standard deviation. Reliability was estimated using McDonald's Omega (Geldhof et al., 2014).

Table 2

Within- and Between-Person Correlations between Positive Affect and Negative Affect in Studies 1-3

	Morning (Study 1/2/3)	School (Study 1/2/3)	Afternoon (Study 1/2/3)	Evening (Study 1/2/3)
Within-person correlation PA-NA	-.40*/-.20*/-.15	n.a. /-.26*/-.27*	n.a. /-.18*/-.27*	-.46*/-.22*/-.26*
Between-person correlation PA-NA	-.52*/.01/-.20	n.a. /.11/-.14	n.a. /.12/-.05	-.54* /.11/-.04

Note. n.a. = not available; positive and negative affect were not assessed at this time point.

* = $p < .05$

Table 3

Model Fit of the Relatedness Satisfaction and Frustration Scales Measurement Models in Studies 1-3

Model	χ^2	Scaling factor	<i>df</i>	RMSEA	CFI	SRMR _{within}	SRMR _{between}	AIC	BIC
Study 1									
1-factor	684.66	1.33	40	.13	.51	.15	.26	24,011.71	24,209.52
2-factor	92.62	1.31	38	.04	.96	.04	.07	23,227.50	23,435.19
Study 2									
1-factor	1,032.00	2.12	40	.15	.52	.24	.29	28,192.09	28,394.68
2-factor	101.88	1.41	38	.04	.97	.04	.06	26,149.50	26,362.22
Study 3									
1-factor	2,431.63	1.25	40	.19	.17	.27	.48	38,642.58	38,860.20
2-factor	100.94	1.71	38	.03	.98	.03	.04	35,780.19	36,008.70

Note. *df* = degrees of freedom; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.

Table 4

Predictions of Children's Positive and Negative Affect Across the Day (Studies 2-3) or in the Evenings (Study 1) by Relatedness Satisfaction and Frustration

Effect	Study 1		Study 2		Study 3	
	Positive affect	Negative affect	Positive affect	Negative affect	Positive affect	Negative affect
Fixed effects						
Intercept	3.75* (0.06)	1.73* (0.04)	3.97* (0.04)	1.86* (0.05)	3.91* (0.05)	1.99* (0.04)
Between-person effects						
Average relatedness satisfaction	0.62* (0.08)	-0.11 (0.06)	0.81* (0.05)	-0.04 (0.06)	0.71* (0.06)	0.04 (0.05)
Average relatedness frustration	-0.06 (0.08)	0.57* (0.06)	-0.03 (0.04)	0.57* (0.05)	0.02 (0.05)	0.66* (0.04)
Within-person effects						
Daily relatedness satisfaction	0.33* (0.05)	-0.06 (0.04)	0.33* (0.04)	-0.05 (0.03)	0.33* (0.04)	-0.11* (0.04)
Daily relatedness frustration	-0.01 (0.04)	0.22* (0.04)	-0.00 (0.02)	0.24* (0.04)	-0.00 (0.02)	0.25* (0.03)
Variances of random effects						
Intercept	0.30	0.16	0.12	0.18	0.22	0.14
Daily relatedness satisfaction	0.04	0.04	0.06	0.02	0.06	0.06
Daily relatedness frustration	0.03	0.06	0.01	0.06	0.01	0.05
Residual variance	0.73	0.57	0.37	0.45	0.35	0.37
Deviance differences (<i>df</i>)						
Random satisfaction effect = 0	4.86 (3)	3.91 (3)	80.81* (3)	23.40* (3)	107.57* (3)	57.45* (3)
Random frustration effect = 0	5.10 (3)	20.43* (3)	5.38 (3)	133.80* (3)	16.94* (3)	93.82* (3)

Note. Parentheses denote standard errors of the estimates of fixed effects. In Study 1, evening positive and negative affect served as dependent variables. In Study 2 and Study 3, the mean value of positive and negative affect measured at school, in the afternoons, and in the evenings served as dependent variables.

* = $p < .05$.

Figure 1. Schematic summary of the estimated effects of relatedness satisfaction and frustration on positive affect and negative affect in Studies 1-3. Results of six multilevel models are displayed. In Study 1, evening affect was predicted. In Studies 2 and 3, the mean of the school, afternoon, and evening sessions was computed, for positive affect and negative affect, respectively. Parentheses denote standard errors of the estimates of fixed effects. Upper estimates and standard errors written in italic refer to the between-person level and lower estimates and standard errors refer to the within-person level. Black circles indicate significant random effects. The dashed line in Study 3 indicates that the within-person effect emerged significant, whereas the between-person effect did not. All dotted lines represent effects that were found to be insignificant ($p > .05$).

* = significant at $p < .05$.

Figure 2. Graphical presentation of the cross-level interaction effect of a child's overall level of relatedness satisfaction on positive affect (Panel a) or relatedness frustration on negative affect (Panel b). The y-axis represents a child's predicted positive affect (Panel a) or negative affect (Panel b) and the x-axis represents relatedness satisfaction (Panel a) or relatedness frustration (Panel b) as the deviation from his or her average reported relatedness satisfaction or frustration, respectively.