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Conflict, Closeness and Comfort: The Inter-Twin Relationship as a Risk Factor for Behavioral Difficulties

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Background: There is currently little evidence concerning the impact of the inter-twin relationship on behavioral outcomes and yet the twin relationship is frequently hypothesized to be a unique source of psychopathology in twins. The current study asked whether the inter-twin relationship is a predictor of behavioral difficulties and whether there are zygosity differences in this relationship. *Method:* An Australian sample of same sex twins (*N* = 356, 164 MZ and 192 DZ) was studied in the year prior to school (Time 1) and again in first year of school (Time 2). Associations between twin-relationship and behavior problems were examined via path-analysis, and Satorra-Bentler chi-square difference tests were used to compare twins across zygosity. *Results:* Results show that both conflict and lower levels of warmth at Time 1 were predictive of hyperactivity and conduct disorder at Time 2, but they were not associated with emotional difficulties or peer problems. While DZ twins shared less warmth than MZ twins, there were no differences in behavior problems. *Conclusion:* Conflict and lower levels of warmth in the inter-twin relationship are associated with hyperactivity and conduct disorder and may serve as important considerations when making decisions regarding class separation at entry to school.

■ **Keywords:** sibling warmth, sibling conflict, closeness, inter-twin relationship, behavior difficulties

There is now considerable evidence that documents the importance of the relationship between siblings on child development (Dunn, 2004; Dunn & McGuire, 1992). Interactions between siblings, both positive and negative, have been found to be key sources of social learning, while the emotional quality of the sibling relationship may serve to provide support or act as a stressor (Bank et al., 2004; Bowes et al., 2010; Dunn et al., 1994; Gass et al., 2007; Jenkins & Smith, 1990; Patterson, 1984; Pike et al., 2005). Sibling relations not only impact on immediate developmental experiences, but have been found to have long-term effects on broader social relationships and risk for psychopathology (Garcia, 2000). To date, research evidence on sibling relationship derives almost entirely from studies of single-born children, yet in twin populations it is likely that there is a more intense effect of sibling relationship.

Twin siblings commence their relationship at conception and spend much greater proportions of the early lives together than single-born siblings (Thorpe & Danby, 2006; Thorpe et al., 2003). Far less is known about the impact of the inter-twin relationship on behavioral outcomes, and yet the twin relationship has been proposed as a unique potential source of psychopathology in twins (DiLalla, 2006; Hay & Preedy, 2006; Rutter & Redshaw, 1991; Stewart, 2000) and is often a key factor in developmental decisions such as that concerning separation on entry to school (Staton et al., in press). The current article addresses two research questions concerning the inter-twin relationship and behavioral difficulties: first, it asks whether the inter-twin relationship is a predictor of behavioral difficulties; and second, whether there are zygosity differences in these relationships. In examining these questions, two key dimensions of the inter-twin relationship, one emotional (warmth/ close-

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ness) and the other behavioral (conflict) are examined as predictors of behavioral outcomes.

Attachment theories propose that positive familial relationships serve as a foundation for strong and functional relationships beyond the family and thereby are a mechanism for long-term emotional wellbeing (see Cassidy & Shaver, 2008). In singleton populations, poor sibling relations involving high levels of conflict and low levels of warmth, have been associated with negative and conflicting peer relations (Lockwood, 2001; Stormshak, 1996), while receiving comfort and emotional support (i.e., high levels of warmth) from a sibling has been found to be associated with positive peer relations and to benefit children's social adjustment (Buhrmester, 1992; Buhrmester, 1987; Jenkins & Smith, 1990; Lamarche, 2006). In contrast, a close inter-twin relationship has been hypothesized to be a potential limitation on both twin children's independence and their social interaction with peers (DiLalla, 2006; Hay & Preedy, 2006; Stewart, 2000). In theoretical accounts, close inter-twin relationships have been presented as excluding of others, lacking 'maturity', and failing to balance twin and individual identity (Hay & Preedy, 2006). Although there are currently no published systematic population studies of the association of inter-twin relationships and behavioral outcomes, there are documented case studies of close and exclusive inter-twin relationships that are associated with psychopathology (Johnson & Johnson, 1982; Luria & Yudovich, 1959; Wallace, 1996).

Social learning theories provide a cognitive explanation for the association of sibling relationships and behavioral functioning. Exposure to diverse social experiences and models is hypothesized to provide opportunities for development of social cognition (e.g., the understanding of another's perspective) and attendant social skills (e.g., the ability to negotiate, share, and resolve conflict; Hughes & Leekam, 2004). Empirical studies of twin children's social interactions indicate that these are more limited compared to single-born children, although these studies are largely confined to the first years of life (Lytton et al., 1977; Thorpe et al., 2003). Less is known about twin children's social experiences outside the home environment. Studies of social cognition have found an advantage in development of ability to understand the perspective of another for single-born children who have siblings, however this advantage is not found for twin siblings (Cassidy et al., 2005). The explanation proposed is that twin children are too similar and do not offer each other sufficient diversity in social learning opportunities. Analyses in this study, however, did not examine potential zygosity differences. The genetic relatedness of twin children has been found to influence the way they feel and act towards their co-twin (Neyer, 2002; Segal, 1999). Zygosity also affects peer relations. MZ twins more often nominate their co-twin as a friend, share more friends with their co-twin and spend more time together than DZ twins (Rose, 2002; Thorpe, 2006). These findings suggests that MZ twins experience less diversity and perhaps greater intensity in their peer relationships compared to DZ twins and, as a consequence, differ significantly from DZ twins on their level of closeness, warmth and conflict. Should this be the case it would be hypothesized that MZ pairs would have more restricted social learning opportunities and have greater risk of behavioral difficulty.

In the current study the exploration of the effects of inter-twin relationship on behavioral difficulties is focused on twin children in the context of transition to school. The inter-twin relationship and association with behavioral outcomes were assessed in the preschool year and again in the first year of school to allow examination of directionality of association between relationship characteristics and behavioral outcomes. The study's focus on the period of school transition is of particular importance when considering twin children because at this time the inter-twin relationship is the focus for decisions about placement in separate or shared classes (Hay, 2004; Hay & Preedy, 2006; Staton et al., in press). School transition also marks a period when there is a broadening social world and increased behavioral restrictions imposed by the routines and rules of the school setting. Unlike single-born children this transition occurs alongside a sibling and provides the opportunity to examine if the relationship with a co-twin serves to protect from or exacerbate behavioral problems at this time.

Method

Participants

Participants were part of a national Australian Research Council funded project examining twin children's social development and transition to early schooling. Recruitment was conducted with the assistance of the Australian Multiple Births Association (AMBA) and the Australian Twin Registry (ATR) via mail-out of study information to members and advertisements in magazines and club newsletters. The study was conducted across two time points: in the year prior to school (Time 1), and the first year of formal schooling (Time 2). The families received postal questionnaires, along with informed consent. Survey data was returned via prepaid postal packages provided. For AMBA and other media advertisements it is not possible for us to know how many people viewed the advertisement and therefore the response rates for this sample are not known. However, positive responses for those approached by the ATR were 288 (144 pairs) from a possible 1028 twin children (514 pairs).

Parents reported on both the children's sibling relations and behavior problems at Time 1 and Time 2. In addition, children reported on their closeness with their twin using a pictorial representation (Friendship Sticker Task). At

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Time 1, participants were 356 same-sex twins comprising 164 MZ (45.1% boys) and 192 DZ (56.3% boys). At Time 2, participants were 274 twins (134 MZ and 140 DZ). Mean age at first assessment was 58 months (4.8 years) (SD = 6.01) and ranged from 43 months to 77 months. Thus the children were aged 3–6 years at Time 1 and 4–7 years at Time 2.

To examine potential differences in participants who did (77%) and did not (23%) return questionnaire data at Time 2, attrition analyses were conducted using chi-square difference tests and t tests for the continuous measures. There was only one difference found among all study variables available at Time 1; this was for very low birthweight (48.7% vs. 63.8%) (χ^2 = 5.01, df = 1, p = .03). The effect size, however, was small (Cohen's d = .18).

Measures

Behavioral difficulties. Behavioral difficulties were measured via parent reports on The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997; 2001). The SDQ is a brief behavioral screening instrument for children aged 4 to 16 years. The measure has four subscales of behavioral difficulties comprised of 5 items each: emotional difficulties, hyperactivity, peer problems, and conduct disorder. Cronbach's alpha for the emotional subscale in the current study was α = .63 (M = 1.87, SD = 1.82) at Time 1, and α = .67 at Time 2 (M = 1.82, SD = 1.93); Cronbach's alphas for the Peer Problems were α = .54 (M = 1.10, SD = 1.43) at Time 1, and α = .59 (M = 1.02, SD = 1.42) at Time 2; Cronbach's alphas for hyperactivity were α = .82 (M = 3.61, SD = 2.64) at Time 1, and α = .81 (M = 3.43, SD = 2.59) at Time 2. Cronbach's alphas for the Conduct disorder were α = .63 (M = 1.74, SD = 1.70) at Time 1, and α = .60 (M = 1.42, SD = 1.48) at Time 2.

Inter-twin relationship. Sibling warmth and conflict were measured via parent report and in addition each twin child reported on their closeness. Warmth was measured at Time 1 via parent report on five items from the extended version of the Share Index (Thorpe & Danby, 2006; Thorpe et al., 2003). These questions asked about the frequency of a range of interaction behaviors, such as how often do they 'hug or cuddle one another', 'show concern for other if hurt or upset'. These items were coded on a 4-point Likert frequency scale such that higher scores reflected low warmth and were summarized into a total score. Cronbach's alpha was α = .78 (M = 3.06, SD = 2.41). Conflict was computed via five items (e.g., hit each other, tease each other) from the Share Index. These items were coded so that higher scores reflected more conflict, and were summarized into an overall score. Cronbach's alpha was α = .82 (M = 9.39, SD = 3.02). Closeness with co-twin was measured via child reports of their relationship on 'The Friendship sticker task' at Time 1 (Thorpe, 2003). In this task a pictorial representation of the target child is used against which he or she is asked to place stickers representing each of their friends and their co-twin. Closer placement of 'co-twin sticker' to them indicated closer relationship. This was summarized into an overall score with 0 = placement on top of their own sticker (24.7%), 1 = next to themselves (10.7%), 2 = two placements from self (17.7%), 3 = three placements away from themselves (36.5%), and 4 = four placements or more from self (9.8%).

Family background. Maternal age was reported by the mother and ranged from 23 to 49 (M = 36.7, SD = 4.24). Number of siblings were coded as one =1 (0%), two =2 (29.2%), three = 3 (43.8%), and four or more = 4 (27%). The sample used in the current study had available only limited data describing family background. To determine SES, the participant's family residential address was matched to the Australian Bureau of Statistics (ABS) Social-economic indexes for areas (SEIFA). The SEIFA index of relative socio-economic disadvantage (IRSD) uses a summary of information about the social and economic resources of people and households within an area to provide a broad measure of relative disadvantage for that area (Pink, 2008). In the current study, this variable was dichotomized and coded so that high score (1) represented those within the top 10% most disadvantaged areas, while (0) represented those not in these areas. The representativeness of this index was then compared with more detailed descriptive data of maternal education available for a subsample of the study population (n = 227), and was positively correlated r =.35 with high maternal education.

Birth characteristics. Birth complications were summarized by the number of birth-related complications (e.g., placental difficulties, umbilical cord complications, jaundice/yellow, forceps, breech, breathing problems, anaemia), and ranged from 0 to 11 (M = 2.05, SD = 1.9). Birthweights were reported by the parents at T1, and coded so that higher score represented low birthweight from ≤ 2500 = 2 (50.8%) and > 2500 = 1 (46.6%, missing = 2.5%). Gender was coded as 0 for girls (48.9%) and 1 (51.1%) for boys. Twin zygosity was determined using a standard zygosity inventory regarding physical similarities (Rietveld, et al., 2000). This form of zygosity determination has been found to have high reliability against biological testing (Sarna et al., 1987; Segal, 1993).

Statistical Analysis

The analytic strategy followed two steps using Mplus Version 5.1 (Muthén, 1998–2007). Correction for family dependence was based on the sandwich or Huber/White variance estimator available in Mplus (Muthén & Muthén, 2005; Williams, 2000). Maximum likelihood estimation with robust standard errors (MLR) was used to account for missing data. Model fit was determined by chi-square estimates, the comparative fit index (CFI, critical value .90; Bentler & Bonett, 1980), the Tucker Lewis Index (TLI, critical value .90; Little et al., Hawley, 2003) and the root

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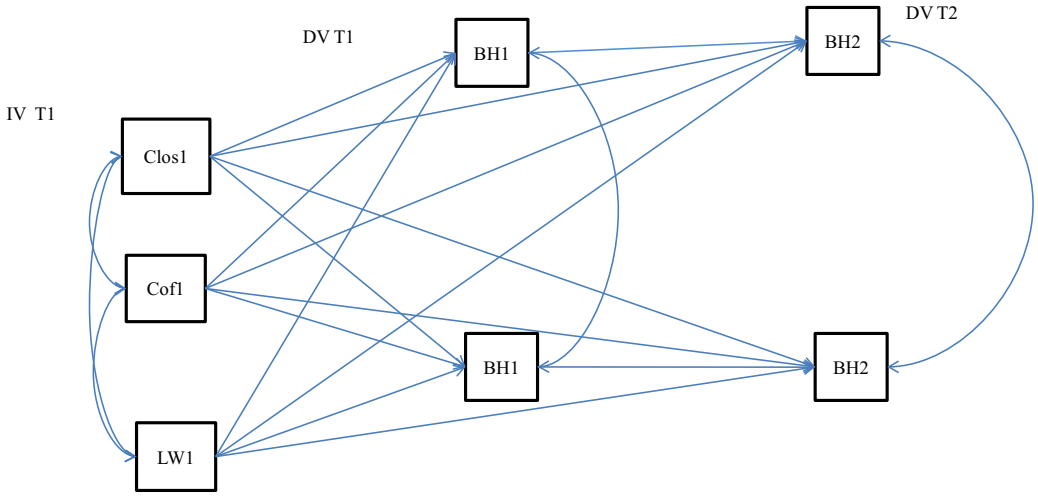

FIGURE 1

Estimated path model: Main effects of inter-twin relationship on behaviour problems across two time points.

Note: BH1: behaviour at Time 1; BH2: behaviour at Time 2; Clos1: Closeness to co-twin at Time 1; Cof1: Sibling-conflict Time 1; LW1: low sibling warmth at Time 1; IV T1: Independent variables; DV T2: Dependent Variables..

mean squared estimate of approximation (RMSEA, critical value .08; Browne & Cudeck, 1993).

In the first step we examined the associations between behavior problems and inter-twin relationship via path-models. Before estimating the full path-model, each association between twin relationship (low sibling-warmth, sibling-conflict and closeness to co-twin) and behavior problems (emotional difficulties, hyperactivity, peer problems and conduct disorder) were examined independently at Time 1 (T1), as well as at Time 2 (T2). Because peer problems and emotional difficulties (T2) were not associated with sibling-conflict, low sibling-warmth or closeness to co-twin, these were omitted from the remainder of the analyses. The full model therefore estimated the direct effects of the inter-twin relationship on hyperactivity and conduct disorder at T1 and T2 simultaneously, as well as T1 behavior on T2 behavior. Contemporaneous behavior problems were correlated within each time-point. We also controlled for potential confounders previously found to be associated with child behavior problems (see Dearing et al., 2006; Duncan & Brooks-Gunn, 1994; Gray et al., 2004; Kelly et al., 2001; Leeuwen et al., 2006); these were maternal age, family disadvantage (SES), gender, low birthweight, and birth complications. Family disadvantage, gender and birth complications were not associated with either hyperactivity or conduct disorder in current study. Therefore, the final model controlled for maternal age and low birthweight only.

The second step examined whether the pattern of associations differed across zygosity. We compared the path model in step 1 by allowing the estimates to freely vary for MZ and DZss twins (unconstrained), to a model where all parameters were held invariant between the groups (constrained). Satorra-Bentler Chi-Square difference tests (Muthén & Muthén, 2005) were used to compare the two models. In addition we examined mean differences for all variables between MZ and DZss twins, using *t* tests, computed in SPSS version 17.1.

Results

1. Does inter-twin relationship predict behavior problems at preschool (Time 1) and school entry (Time 2)?

Before estimating the full model we examined associations between sibling relationships (sibling-conflict, low sibling-warmth and closeness to co-twin) measured at Time 1 and behavior problems at Time 1 (T1) and Time 2 (T2) separately. There were no associations found for sibling relationship and peer problems or emotional difficulties, these were therefore omitted from the remainder of the analyses.

The full path model (as indicated in Figure 1) was calculated by estimating direct effects of the three sibling relationship measures on behavior problems at T1 and T2 simultaneously, while controlling for potential confounders (low birthweight, birth complications, maternal age, low SES, and number of siblings). Figure 2 show the significant associations after adjusting for potential confounders, and show a pattern of stability in both hyperactivity and conduct disorder from T1 to T2 (β = 0.64). Sibling conflict was further associated with both hyperactivity and conduct disorder at T1. Sibling conflict also predicted conduct disorder at T2. Sibling closeness, however, was only associated with conduct disorder at T1, while low sibling warmth was only associated with hyperactivity at T2. Additionally, maternal age was positively associated with conduct disorders at T2 (β = 0.10, p <

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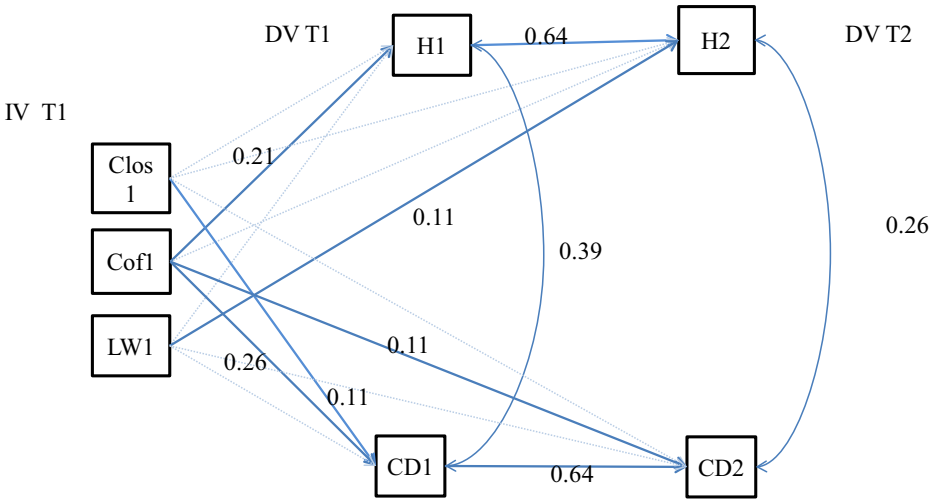

FIGURE 2

Adjusted path model: Significant main effects of inter-twin relationship on conduct disorder and hyperactivity across two time points.

Note: IV T1: Independent variables at Time 1; DV T2: Dependent Variables at Time 1; DV T2: Dependent Variables at Time 2; Clos1: closeness to co-twin at Time 1; Cof1: Sibling-conflict Time 1; LW1: low sibling warmth at Time 1; H1: Hyperactivity at Time 1; H2: Hyperactivity at Time 2: CD1: Conduct disorder at Time 1; CD2: Conduct disorder at Time2.

All Beta-coefficients are adjusted standardized, significant estimates are in bold ($p < .01$).

.05), and low birthweight was positively associated with hyperactivity at T2 ($\beta = 0.17$, $p < .05$).

2. Do MZ twins differ from DZs in associations between twin-relationship and behavior problems? In the second step, we compared the associations found in step 1 across zygosity (MZ vs. DZss). Thus two competing models were examined by comparing a model where we allowed the estimates to freely vary for MZ and DZss zygosity group (unconstrained) to a model where all parameters were held invariant between MZ and DZss group (constrained). Model fit for the constrained model, $\chi^2(df = 20) = 22.17$; $p = 0.33$, CFI 0.99; TLI = 0.99; RMSEA = 0.03, did not significantly differ, χ^2 (df = 16) = 11.08 p = NS) from the unconstrained model, $\chi^2(df = 4) = 5.26$; $p = 0.26$ CFI 1.00; TLI = 0.97; RMSEA = 0.04. In addition we examined mean differences of all the variables in the overall model. Mean differences was computed by independent t tests in SPSS 17.0, and showed that DZ twins, $M = 3.40$, $SD = 2.36$, had lower levels of sibling warmth compared to MZ twins, $M = 2.66$, $SD = 2.41$, $t(354) = -2.94$, $p < .01$; however, they did not significantly differ in mean levels of behavior problems measured at either Time 1 or Time 2.

Discussion

The aim of the current study was to examine the association between conflict, warmth and closeness in the inter-twin relationship and behavior problems, and further to examine whether the patterns of association between inter-twin relationship and behavioral outcomes were different for MZ and DZ twins. Our study was undertaken in the context of children entering their first year of school. This is a key transition point for all children but one with particular significance for twin children because it is often the first point where decisions about separation are made. At this time the focus on the inter-twin relationship is central (Staton et al., in press).

The results indicate that features of the twin relationship are associated with externalizing forms of behavioral difficulty, both hyperactivity and conduct problems. Sibling conflict and lower sibling closeness prior to school entry were associated with concurrent externalizing behavior, while sibling conflict was also predictive of conduct disorders after school entry. Low sibling warmth prior to school entry was not significantly associated with concurrent hyperactivity but was found to predict hyperactivity once the children had entered school. These findings are in line with the literature on singleton siblings that indicates that a positive sibling relationship is a predicator of behavioral functioning (e.g., Buhrmester, 1992; Jenkins & Smith, 1990). It should be noted that there cannot be absolute certainty of the direction of effect for concurrent measures of sibling-relationship and behavior difficulties. The prospective prediction of externalizing problems, however, suggests that an inverse causal effect is highly unlikely. In the case of hyperactivity where an association with low sibling warmth only emerged after school entry, an alternative explanation is that the context change may have an important effect. How this effect relates to other features of the child's

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environment, such as class placement decisions, is unclear and warrants further investigation.

Importantly, features of the inter-twin relationship were not found to predict internalizing behaviors. The results indicate no association between conflict, warmth or closeness in the inter-twin relationship and either peer problems or emotional difficulties. The hypothesized restriction of the inter-twin relationship on emotional functioning and peer interactions (DiLalla, 2006; Hay & Preedy, 2006) particularly in close relationships (Hay & Preedy, 2006; Sandbank, 1999; Stewart, 2000) is not supported by the data. Close and warm relationships between twin siblings, like those between singleton siblings (Buhrmester, 1992; Jenkins & Smith, 1990) do not constitute a risk and may afford some protective qualities as seen in the findings pertaining to hyperactivity.

In line with previous research (DiLalla & Caraway, 2004) the current study found mean differences across measures of sibling relationship between MZ and DZ pairs. However, in regard to the question concerning patterns of association between measures of sibling relationship and behavioral outcome our findings indicate no significant differences.

There are two aspects of the design that should be noted in interpreting these results. First, the sample used in this study was drawn from the volunteer-based Australian Twin Registry (ATR). Thus, as with all volunteer studies, there is the possibility of recruitment bias. However, to help to overcome this bias we supplemented the sample through direct requests via the Australian Multiple Birth Association (AMBA), and media, with the aim of obtaining a diverse recruitment sample. Second, both measures of behavior and sibling relationship (warmth and conflict) were based on parental ratings. As such, there is the possibility that the association between risk factors and child outcomes may be an over-estimate. To help overcome this bias the study also employed direct child report of the co-twin relationship in addition to parental report.

Implications and Conclusion

Our study examined the association of sibling relationship and behavioral outcomes across the period of transition to school. This is an important transition point for twin children when the sibling relationship comes into particular focus in considering decisions about whether to place twin children together or in separate classes. The data presented here suggest that conflicted relationships or those characterized by low warmth may give cause for consideration of separate placement. Conflicts, in particular, would seem to be important markers of risk for later behavioral difficulty. Contrary to concerns that closeness may exclude other relationships (DiLalla, 2006; Hay & Preedy, 2006; Stewart, 2000), this study provides no evidence that close relationships are associated with behavioral problems. There is a need for further exploration of how sibling relationships map onto decisions regarding class placement and, further, how individual differences in inter-twin relationship map onto emotional and achievement outcomes in school.

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