How well do parents know their adolescent children? Parent inferences of student self-concepts reflect dimensional comparison processes

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Abstract

The internal/external frame of reference (I/E) model posits paradoxical relations between achievement and self-concept in mathematics and verbal domains. There is strong support for the I/E model based on student self-ratings, however, reviews of self-concept research claim that the I/E model does not apply to ratings by parents and significant others. We aimed to test these claims using parent inferred self-concepts. In contrast to widely cited claims, we found support for I/E model for both students (N = 486; aged 11–17; 57.2% female) and their parents (80.5% female). Math and verbal achievement had positive effects on self-concepts in the matching domain (e.g., math achievement predicting math self-concept) but negative effects for self-concepts in the non-matching domain (e.g., math achievement predicting verbal self-concept). Integrating conflicting claims, we found support for dimensional comparison processes for inferred self-concept ratings by parents, but not for parent perceptions of student abilities similar to the measures used that were the basis of previous claims.

How well do parents know their adolescent children? Parent inferences of student self-concepts reflect dimensional comparison processes

Academic self-concept has been established as both a predictor of educational success and as an important outcome in and of itself in developmental and educational psychology (Marsh, 2007). Here we briefly review the Internal/External (I/E) model relating math and verbal achievement to corresponding measures of academic self-concept. Although I/E predictions are very robust for responses by students, there is little research on inferred self-concept ratings by parents despite oft-cited claims that I/E predictions do not generalize to responses by parents (e.g., Dai, 2002, Marsh, 2007, Marsh et al., 2015a, Marsh et al., 2015b, Marsh et al., 2014). Filling this important gap in self-concept literature, we test the I/E model on a sample of 486 dyads of Australian adolescents and their parents.

1. The role of comparative processes in self-concept formation

Since William James (1890/1960), psychologists have stressed that self-concept cannot be understood without recognizing the role that comparative processes play in perceptions of the self. Essentially, while some people may share objective characteristics or accomplishments, differing standards of comparison or frames of reference can lead to disparate self-concepts among individuals (Van Zanden, Marsh, Seaton, & Parker, 2015). Educational research has focused on three types of comparison processes: 1) social, 2) temporal, and 3) dimensional.

Festinger (1954)'s social comparison theory has been pivotal in highlighting the role of external frames of references in self-conceptions. Festinger's theory explains how self-concept can be influenced when people compare themselves against those around them. For instance, a student who performs well at school might develop low academic self-concept if they transfer to a high achieving school, despite their objectively excellent performance relative to the wider population. Albert (1977)'s work on temporal comparisons was also significant in highlighting the importance of comparison processes performed within a historical frame of reference, whereby individuals assess their current performance in the context of previous performances. For example, a student is likely to gain an increase in self-concept if they excel in an exam in a subject they had previously struggled in. Albert (1977)'s work on temporal comparisons was significant as it highlighted how frames of references beyond traditional social comparisons are critical to the way people self-evaluate.

However, when considered alone social and temporal comparisons fail to explain why academic self-concept is so content specific (Marsh, 2007; see Marsh & Shavelson (1985) for an overview of domain specificity of self-concept). In overcoming this limitation, Möller and Marsh (2013) focused on dimensional comparison processes as the core mechanism behind the formation of differentiated subject specific academic self-concepts. According to Möller and Marsh, dimensional comparisons take place within an internal frame of reference, whereby people compare their own abilities in one area to another, resulting in ipsative relationships between domains. For example, a student may ask, “How good am I in mathematics compared to English?” Essentially, more positive evaluations in one domain will have a suppressing effect on evaluations in other domains, leading to a decreased self-concept in the domain judged as poorer by comparison. Importantly, this process can occur even when differences in objective achievement are reasonably small.

Marsh (1986) argues that it is these dimensional comparisons that lead to the lack of correlation between mathematics and verbal self-concepts despite closely related mathematics and verbal achievement levels. These dimensional comparisons are the focus of the I/E model, which posits that internally based dimensional comparisons, in addition to

external comparisons, are the core mechanisms behind the formation of differentiated subject specific academic self-concepts (Möller & Marsh, 2013). Such a model has important practical implications, as differentiated self-concepts play a role in educational and career choices (Eccles, 1992) and may help to explain lower female uptake of degrees and careers in the physical sciences, mathematics, engineering, and technology (Parker, Nagy, Trautwein, & Lüdtke, 2014).

Central to the I/E model are the findings of Marsh (1986). In accordance with the hierarchical aspect of self-concept, Marsh found that correlations between mathematics and verbal self-concepts are typically weak or even negative. Furthermore, it was demonstrated that correlations between domain specific achievement (e.g., mathematics or English) and their corresponding self-concepts were substantial and positive. Meanwhile, paths from mathematics achievement to verbal self-concept, and vice versa, were significant and negative (see Fig. 1). Essentially, people tend to see themselves as either a math or verbal person, but rarely both.

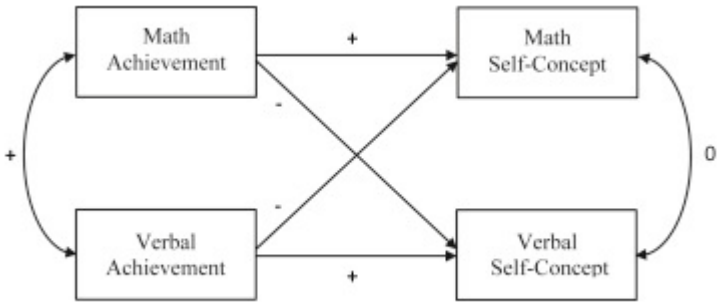

Fig. 1. Expected student I/E model pathways relating verbal and math achievement to verbal and math self-concepts.

Despite the fact that people typically see themselves as either mathematically or verbally oriented, Marsh (1986) found that objective measures of academic performance actually paint a different picture. That is, while a significant distinction between mathematics and verbal self-concepts exists for students, objective measures of academic performance in mathematics and English are typically closely correlated to one another. In essence, Marsh demonstrated that individuals, who perform well in mathematics, also perform well in subjects emphasizing verbal skills (and vice versa), despite the fact that mathematics and verbal self-concepts are almost uncorrelated. In sum, there is a paradoxical relationship that exists between academic self-concepts and their corresponding measures of academic performance.

2. Empirical support for the I/E model

Following the original Marsh (1986) demonstration, there has been consistent, widespread support for the I/E model and its related dimensional comparison processes, making it one of the robust findings in educational psychology and psychological research more generally (see Helm et al., 2016, Marsh and Hau, 2004, Marsh et al., 2015a, Möller and Husemann, 2006, Möller and Köller, 2001, Möller et al., 2009, Pohlmann and Möller, 2009). For example, in a large cross-cultural study, Marsh and Hau (2004)demonstrated that support for the I/E model generalized over large, nationally representative samples of 15-year-olds from each of 26 countries using PISA data. In a subsequent meta-analysis of 69

datasets Möller et al. (2009)reported that math and verbal achievements were highly correlated ($r = 0.67$), while self-concepts were nearly uncorrelated ($r = 0.10$). The horizontal paths from achievement to self-concept in the matching domains were positive ($r = 0.61$ for math, 0.49 for verbal), but cross-paths were negative ($r = -0.21$ for math achievement predicting verbal self-concept; -0.27 for verbal achievement predicting math self-concept). Furthermore, Möller and Köller (2001) found support for the causal hypothesis of the model by showing that experimental manipulation of feedback in achievement in one subject resulted in a positive effect of academic self-concept in the matching domain, but a negative effect on self-concept in a contrasting domain. Moreover, qualitative student diary studies have provided evidence that students spontaneously undertake dimensional comparisons on a day-to-day basis (Möller & Husemann, 2006), thereby providing support for the I/E model as an externally valid perspective on self-concept. Finally, there is emerging longitudinal evidence suggesting that I/E model predictions have implications for student self-concept development (Möller et al., 2011, Möller et al., 2014, Niepel et al., 2014, Parker et al., 2015).

3. Generalizability to self-other agreement between parents and students

Despite consistent support for the I/E model based on student self-concept ratings, there is surprisingly little research evaluating the generalizability of the IE model to inferred self-concept ratings by significant others (e.g., parents, teachers, peers). There is, however, a substantial body of literature on self-other agreement in self-concept ratings. Inferred self-concept ratings by significant others are used to determine how accurately self-concept can be inferred by external observers, to validate interpretations of responses to self-concept instruments, and to test a variety of theoretical hypotheses such as those derived from the symbolic interactionist perspective.

Early reviews (e.g., Shrauger & Schoeneman, 1979) concluded that “there is no consistent agreement between people's self-perceptions and how they are actually viewed by others” (p. 549). However, recent research paints a more complex picture of the degree to which others can interpret internal states and self-perceptions of another person – it seems that the type of relationship and the type of measure is crucial to determining another's ability to accurately infer another's internal state or self-perceptions. Self-other agreement between teacher and student judgments is often low, showing that teachers often have difficulty judging the internal states of their students, especially for mood, subjective wellbeing, anxiety and academic motivation (Ambady and Gray, 2002, Auger, 2004, Givvin et al., 2001, Spinath, 2005, Urhahne and Zhu, 2015). Interestingly, results from Spinath and Urhahne, Chao, Florineth, Luttenberger, and Paechter (2011) show a higher self-other agreement for self-concept as opposed to other affective and motivational constructs. In contrast to the findings on teachers, people who are closer with the student (e.g., parents) are more likely to accurately infer self-concepts. For example, multi-trait multi-method (MTMM) studies provide clear support for the convergent and discriminant validity of multiple dimensions of self-concept in relation to student self-concepts and inferred self-concepts by significant others (Marsh, 1990, Marsh, 2007). In particular, Marsh and Byrne (1993)found a large self-other agreement between self-concept ratings by university students with those inferred by the person in the world who knew them best, frequently a parent ($r = 0.57$ across 13 domains). They concluded that self-other agreement was substantial, particularly for older students, when: a) both students and significant others made their responses on the same well-developed instrument consisting of multi-item scales; b) self-other agreement was for specific characteristics rather than for broad, ambiguous characteristics or an overall self-concept; and c) the significant others knew the students

between in a wider range of context than the observers in most research. Importantly, these criteria are met in the present study.

Together these findings suggest that parent inferred self-concepts are likely to fit a pattern of results congruent with I/E predictions. Nevertheless, based primarily on a single study claiming to test the I/E model for parallel responses by students and their parents (Dai, 2002), Marsh (e.g., Marsh, 2007, Marsh et al., 2015b, Marsh et al., 2014) has repeatedly concluded that when parents are asked to infer the self-concepts of their children, their responses do not reflect internal comparison processes. Similarly, in the Möller et al. (2009) meta-analysis of I/E studies, the authors concluded that:

In related research, Dai (2002) reported that the self-concept ratings inferred by parents primarily reflected the external comparison process typically emphasized in social comparison research but not the internal comparison process that is the unique feature of the I/E model. (p. 1161)

However, a more careful evaluation of the Dai (2002) study calls into question the appropriateness of this conclusion and implications drawn from it. Dai clearly showed support for I/E predictions based on student self-concept ratings but not for parent ratings. Nonetheless, parents ratings were not inferred self-concepts, but rather parent perceptions of their child's abilities. Dai emphasized that parent ratings were "parent perceptions of their children's abilities" (p. 617) and concluded that:

Probably the most revealing finding of this study is that parents did not seem to use the I/E the way their adolescent children did in assessing their academic abilities. The internal reference effects were absent. … Together, these results suggest that although adolescents tend to use relative (both internal and external) performance standards in self-assessment of ability in specific subjects, parents seem to use more absolute criteria in assessing their children's performance and ability (p. 636–637).

This critical difference between parent inferred self-concepts and their perceptions of their child's ability has been ignored, or at least not recognized, in reviews. Importantly, Dai (2002)'s item measured the parent's perception of their child's ability (i.e., "*My child's academic achievement in (Maths/English) is extremely good"*). In contrast, parent inferred self-concepts measure the parent's perception of their child's self-concepts (e.g., *"My child thinks that he/she has always done well in maths"*; see Appendix for a list of items in parent inferred self-concept scale versus parent perception of ability). Thus, both measures tap into quite separate, but equally important constructs. Indeed, it is, perhaps, unsurprising that ability perceptions behaved more like actual measures of achievement than students' self-concepts. Thus, the unanswered question and focus of the present investigation, is whether support for the I/E predictions generalizes to inferred self-concept ratings by parents as opposed to their perceptions of the abilities of their child.

4. Research hypotheses

The hypotheses of this study are as follows:

Hypothesis I

Convergent and divergent validity. h_1 hypothesized that there would be strong convergent validity for matching self-concept and achievement scores, and strong divergent validity for non-matching areas of self-concept. Furthermore, based on previous self-other literature using parents and significant others (e.g., Marsh & Byrne, 1993), it was expected that a high degree of self-other agreement would be observed across student and parent responses.

Hypothesis II

I/E model in students. h_2 hypothesized that the I/E model would be replicated in students (see Fig. 1): horizontal paths relating achievement to matching domains are positive (e.g., math achievement to math self-concept) and cross-paths relating achievement in one domain to self-concepts in a contrasting domain are negative (e.g., math achievement to verbal self-concept).

Hypothesis III

Extending the I/E model to parents. To address the potentially erroneous over-interpretation of the Dai (2002) study, the present study explored the question, "Does the I/E model extend to parent perceptions of student self-concept?" We predict that the I/E predictions (see above) would be supported by inferred self-concept responses by parents, but not for parent perceptions of the abilities of their children.

5. Method

5.1. Participants

This sample was part of a larger study (N = 2786 students from metropolitan Sydney Australia), funded by the Australian Research Council, "Realising Gifted Students' Potential: Elucidating psychosocial determinants and impact of different educational settings on educational outcomes and psychosocial wellbeing." Our study is based on 486 adolescents (age 11–17; *M* = 13.71, *SD* = 1.16) who had matching responses available from their parents (80.5% female). Students were 57.2% female; primarily working and middle class; 79% Australian born; 11.3% spoke an East Asian language at home. Questionnaires, information letters, and consent forms were distributed and collected by the students, roll call teacher. A researcher was available during student administration to provide help to any students experiencing difficulties.

5.2. Instruments

5.2.1. Academic Self-Description Questionnaire II

Academic self-concept responses were based on the Academic Self-Description Questionnaire (ASDQII; Marsh, 1990, Marsh, 1992), considered to be the most validated multidimensional academic self-concept instrument for adolescents (Byrne, 1996). Here only math self-concept and verbal self-concept were used and the six parallel-worded items for each scale (e.g., "I have always done well in math") were measured on a six-point Likert scale (1 = *strongly disagree*; 6 = *strongly agree*). Coefficient alpha estimates of reliability were 0.90 for each scale.

Parents completed a modified version with parallel-worded items except that the word "I" was replaced with "my child thinks". Reliability estimates of these inferred academic self-concepts were 0.91 (inferred verbal) and 0.92 (inferred math). In addition, parent perceptions of ability in math and English were measured with a single item, "My child's academic achievement in (Maths/English) is extremely good". Parents completed the modified materials either online or in paper-and-pencil format.

5.2.2. The Wide Range Achievement Test 4

Achievement was based on responses to the math (mathematics computation) and verbal (spelling) components of the Wide Range Achievement Test 4 (WRAT4; Wilkinson & Robertson, 2006). The spelling component required students to spell words that were read out alone and then in context by the test administrator. The math component of the test required students to answer 40 mathematics questions involving basic skills of addition, subtraction, multiplication, division, and pattern solving. Across the two administrations, the reliabilities

were 0.87 and 0.86 for spelling and 0.88 and 0.90. The relationships between the WRAT4 and other achievement tests and cognitive assessments have indicated that the WRAT4 is an appropriate tool for measuring verbal achievement in young people (see Wilkinson & Robertson, 2006).

5.3. Statistical analyses

All analyses were done with M*plus* 7.3 (Muthen & Muthen, 2008–14). We used the robust maximum likelihood estimator (MLR) that is robust against any violations of normality assumptions and full information maximum estimate likelihood (FIML) even though there was almost no missing data (less than 1% missing).

5.4. Preliminary analyses

Our main substantive interest is in relations among the latent variables. However, rigorous psychometric tests of the measures is important, particularly as the factor ASDQII responses by parents and its relation to that by student has not previously been tested. Preliminary Confirmatory Factor Analyses described in detail in Supplemental Materials demonstrate: (a) rigorous tests of factorial invariance for the factor structure based on student academic self-concept responses and parent inferred academic self-concept responses (Hypothesis 1); and (b) relations between academic self-concepts, inferred academic self-concepts, and achievement provide good support for the convergent and discriminant validity of the ratings (based on the latent correlation matrix of relations among the constructs—see subsequent discussion of Table 1).

Table 1. Descriptive statistics.

	M	*SD*	*SK*	*KT*
Math achievement	0.69	0.15	−0.34	0.66
Verbal achievement	0.69	0.12	−0.29	−0.08
Math self-concept	4.40	0.94	−0.82	0.08
Verbal self-concept	4.46	0.89	−0.47	0.78
Parent math self-concept	4.23	1.02	−0.63	0.19
Parent verbal self-concept	4.33	0.93	−0.64	0.69
Parent perception of math ability	4.17	1.25	−0.39	−0.42
Parent perception of verbal ability	4.24	1.16	−0.49	0.01

Note: *M* = Mean; *SD* = Standard Deviation; *SK* = Skewness; *KT* = Kurtosis.

Table 2. Correlations among latent variables.

Variables	1	2	3	4	5	6	7
Student self-concept ratings							
1. Math							
2. Verbal	**0.02**						
Parent inferred self-concept ratings							
3. Math	0.67	−0.11					
4. Verbal	−0.04	0.62	**0.14**				
Parent ability perceptions							
5. Math	0.52	−0.05	0.75	0.19			
6. Verbal	−0.01	0.45	0.16	0.78	**0.46**		
Achievement tests							
7. Math	0.42	−0.08	0.45	0.13	0.37	0.14	
8. Verbal	0.09	0.11	0.18	0.36	0.20	0.34	**0.62**

Note: All correlations greater than 0.10 are statistically significant ($p < 0.05$). Bolded cells show correlations in non-matching domains crucial to the I/E model hypothesis.

5.5. Confirmatory factor analysis (CFA)

CFA was used to assess the extent to which observed variables (i.e., scores on individual items in the ASDQII) reflected the structure of underlying latent constructs (i.e., mathematics and verbal self-concepts) (see supplementary materials). This study followed the recommendations of Hoyle and Panter (1995; see also Hu and Bentler, 1999, Marsh et al., 2004), and used the Tucker Lewis Index (TLI), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA), in addition to the chi-square value to assess model fit. In determining goodness of fit, a CFI and TLI of 0.95 or above are considered as indicators of an excellent fitting model; however, values of 0.90 or above are also deemed acceptable (Byrne, 2013, Hu and Bentler, 1999; Marsh et al., 2004a, Marsh et al., 2004). Furthermore, RMSEA values at or below 0.05 are typically indicative of a "close fit" to the data (Browne & Cudeck, 1992; Marsh, & Hau, 1996).

5.6. Invariance testing

In addition to CFA, invariance testing was used to assess whether the factor structure of self-concept was invariant across the sub-groups of gender, grade, and school type (i.e., selective or comprehensive). Invariance was considered to be present if changes between models in the CFI and TLI were no greater than 0.01 (Cheung & Rensvold, 2002; Marsh,

Nagengast, & Morin, 2013). Additionally, Chen (2007) states that the RMSEA should not increase by more than 0.015 if groups are to be considered invariant. In this study, invariance testing was performed to the level of factor loadings being equivalent across groups in order to demonstrate consistency of the ASDQII across the study's major subgroups. This decision was based on the fact that the subsequent structural equation model analyses in this study were performed with covariance based models, which assume factor loading invariance (Marsh et al., 2013).

5.7. Multitrait-multimethod

To answer the hypothesis of whether correlations of the I/E model were replicated in this study (and the convergent and divergent validity of responses), Campbell and Fiske (1959)'s multitrait-multimethod (MTMM) was used. In addition, the MTMM was used to establish whether parent inferred self-concept followed the same pattern as student self-concept ratings. Finally, the MTMM was used to evaluate the rate of agreement between the ratings provided by students and their parents.

5.8. Structural equation modeling (SEM)

SEM was used to test the predictive pathways between students' and parent inferred mathematics and verbal self-concepts, and students, mathematics and verbal achievement across the first and second time waves used in this study. In order to compare the I/E model across parents and students, the data were transformed into long form. The SEM analysis was then conducted as one model.

6. Results

6.1. Latent correlations among constructs: an advanced organizer

6.1.1. Correlations between math and verbal constructs

Based on the best CFA model (see Supplemental Materials), we present a latent correlation matrix of 10 constructs used in the present investigation (Table 1). Of particular relevance is the correlation between the math and verbal components for each of the different constructs. Consistent with previous support for the I/E model, the correlation between math and verbal self-concept (r = 0.02, ns) is close to zero, whilst the correlation between math and verbal achievement is large in size (r = 0.62; p = <0.05). Consistent with Dai (2002) the correlation between parent perceptions of the math and verbal abilities of their students is also noteworthy (r = 0.46; p = <0.05); Dai also reported a correlation of 0.46. However, consistent with our premise that inferred self-concepts are more appropriate for testing the generalizability of I/E model to parent responses, the correlation between parent inferred math and verbal self-concepts (r = 0.14; p = <0.05) is modest. Indeed, the correlation between the two self-concepts inferred by parents is not significantly different than the correlations between the two self-concepts based on child ratings (Wald test = 1.82, p = 0.069), and both are significantly smaller than the correlation between the parent ratings of child abilities and child self-concept (Wald test = 6.77, p < 0.001) and parent ratings of child abilities and parent inferred self-concept (Wald test = 7.01, p < 0.001). This provides preliminary support for the distinctiveness of parent inferred academic self-concepts and perceptions of their child's abilities.

6.1.2. MTMM analysis of student and parent inferred academic self-concepts

Based on latent correlations (Table 1) we evaluated the convergent and discriminant validity of student academic self-concepts and parent inferred self-concepts based on traditional Campbell and Fiske (1959) criteria (see Supplemental Materials for further discussion). Support for convergent validity was strong as student-parent agreement on matching self-concepts exhibited large correlations; 0.67 (math self-concepts) and 0.62 (verbal self-concepts). Support for discriminant validity was also strong in that convergent validities were substantially higher than heterotrait-monomethod (different traits, same method) correlations: 0.02 (math and verbal self-concepts based on student ratings), 0.14 (inferred math and verbal self-concepts based on parent inferred self-concept ratings); heterotrait-heteromethod (different traits, different methods) correlations: −.04 (math self-concept & inferred verbal self-concepts), −.11 (inferred math and verbal self-concepts). Overall, the MTMM analysis provides strong support for the convergent and discriminant validity of student academic self-concept responses in relation to inferred self-concept ratings by their parents.

7. Generalizability of the I/E model for students and parents

Our major focus was to test the generalizability of the I/E model to inferred academic self-concept parent responses. More specifically, extending the I/E model we evaluated the effects of math achievement and verbal achievement on student self-concepts, self-concepts inferred by parents, and parent perceptions of the abilities of their child (see Fig. 2). The main results (see Supplemental Materials for more detail) show that math and verbal self-concepts (based on student ratings as typically used to test the I/E model) provide clear support for the I/E model; paths from achievement to self-concept are positive for horizontal paths to matching domains (0.60 & 0.26) and negative for cross-paths to non-matching domains (−0.27 & −0.24).

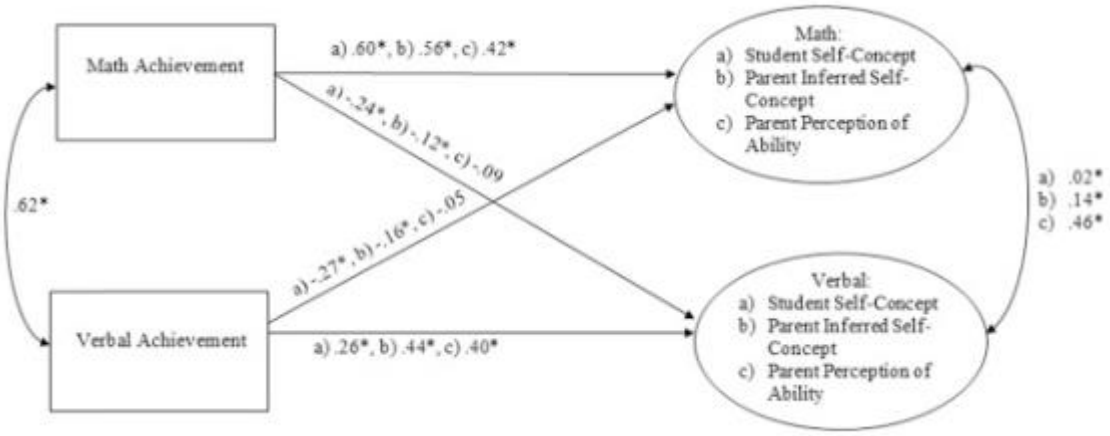

Fig. 2. The Internal/external frame of reference (I/E) model extended with parent responses: Including: a) student academic self-concepts; b) parent inferred self-concepts; and c) parent perceptions of ability, *$p < 0.05$.

Critically, inferred math self-concepts and inferred verbal self-concepts based on responses by parents, used here to test the generalizability of support for the I/E and parent perceptions of child abilities, also provide clear support for the I/E model; paths from

achievement to self-concept are positive for horizontal paths (0.56 & 0.44) and negative for cross-paths (−0.16 & −0.12).

Furthermore, parent perceptions of their child's math and verbal abilities (like those used by Dai, 2002, that has been the basis of claims about the generalizability the I/E model for parent ratings), consistent with findings by Dai (2002), provide no support for the internal comparison process of the I/E model; horizontal paths from achievement to parent perceptions of ability in matching domains are positive (0.42 & 0.40) but cross-paths are all non-significant (−0.05 & −0.09, $p > 0.10$).
In summary the results demonstrate that I/E predictions generalize over student self-concepts and inferred self-concepts by parents. However, consistent with Dai (2002) there is no support for the internal comparison process posited in the I/E model for parent perceptions of their child's abilities; these behave more like measures of achievement.

8. Discussion

The most important finding of the present investigation is that support for the I/E model generalizes over student self-concepts and inferred self-concept responses by their parents, countering the widely-cited conclusion claiming the opposite based on Dai (2002)'s previous study. Furthermore, we demonstrate the basis of the erroneous conclusions drawn in previous reviews of self-concept research. Like Dai, we showed that parent perceptions of the child's abilities followed a similar pattern to achievement measures as opposed to student self-concepts or inferred self-concepts. However, when using inferred self-concept ratings by parents there was support for the generalizability of the I/E model. This study demonstrated that previous reviews of self-concept research misinterpreted Dai's original study by inaccurately describing the results in terms of inferred parent self-concepts. Juxtaposing all three constructs in the same study has provided a strong basis for new conclusions of the generalizability of the I/E model. Now that this support is demonstrated, there is a need to extend these findings to inferred self-concept ratings by other significant others, in relation to other domains of self-concept, and to responses by younger children for which self-other agreement is typically weaker.

Although not our major focus, the results provided very strong support for the convergent and discriminant validity of student academic self-concept responses and inferred self-concepts by their parents. Nonetheless, we note that the correlation between verbal and math self-concepts was larger for parent-inferred reports ($r = 0.14$) than for student self-reports ($r = 0.02$). However, overall the self-other agreement was substantial. Indeed the self-other agreement ($r = 0.67$ and 0.62) is higher than previously found with early/middle adolescent children (but see Marsh & Byrne, 1993, study of university students), due in part to the observation that the study fulfills the criteria for an ideal self-other study recommended by Marsh and Byrne (see earlier discussion).

9. Limitations and future directions for research

While this study's extension of the I/E model to parents was noteworthy, readers should be aware of the limitations that were present in this investigation. Firstly, there is a potential sampling bias in the parent sample stemming from the fact that only 17.5% of parents eligible for participation returned completed surveys. Future research could strengthen this study's conclusions using samples with greater response rates, the use of stronger instruments to measure parent perception of abilities (as opposed to single items), as well as exploring whether the I/E model's predictions apply for a diverse range of verbal achievement indicators outside of the spelling measure used here.

This study used mathematics and verbal domains to test the I/E model; however, there is new and emerging evidence that suggests the contrasts between domains found in the I/E model extends to other opposing domains between the mathematics and English continuum (Marsh et al., 2015a, Marsh et al., 2015b). Further research in the field of the I/E model is needed to better understand how dimensional comparisons in multiple subject areas affect achievement.

This study has highlighted nuances in measuring parent perceptions by showing how parent inferences of child self-concept and parent perceptions of children's ability are conceptually distinct from one another. A future direction for research is further investigation into the distinction between parent inferences of child self-concept, and parent perceptions of their child's ability. Research in this area could determine which of these two measures provide the strongest prediction of later student achievement and self-concept.

Whilst this study has been largely theoretical in focus, a future direction would to be extend on this theoretical work by investigating how dimensional comparison processes in parents and significant others might influence student self-perceptions and achievement (e.g., Do dimensional comparisons inferred by parents place constraints on student aspirations?). Future research could build on these concerns by testing whether parent-inferred dimensional comparisons are predictive of student self-perceptions, aspirations, educational attainment, and career choice.

Finally, as with any research based on correlations, this study notes that there are limitations surrounding the proposal of causal relations between variables. Hence, this study has presented and interpreted results explicitly in terms of prediction and correlation. However, given that in this context a randomized control trial would not have been feasible, correlational research should be regarded as an appropriate alternative for exploring psychological theory. This notion is further supported by the fact that the rationale behind this study's methodological and interpretative decisions were based upon the strong theoretical, empirical, and experimental foundations of the I/E model.

10. Summary and conclusions

In summary, these results have important implications for theory, research, and practice, extending self-concept theory in new and nuanced ways to provide a fertile foundation for further research into self-other agreement and frame of reference effects in ratings by significant others. The results imply that educators, parents, and significant others need to be aware of these effects when attempting to enhance students, academic self-concepts, and need to discourage comparisons in which good achievement in one area results in poorer self-concept in contrasting domains.

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