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Dimensional Comparison Theory: Paradoxical relations between self-beliefs and achievements in multiple domains

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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, in which achievement in each domain has a positive effect on self-concept in the matching domain (e.g., mathematics achievement on mathematics self-concept) but a negative (contrastive) effect on self-concept in the non-matching domain (e.g., mathematics achievement on verbal self-concept). Extending the I/E model, Dimensional Comparison Theory (DCT) posits that self-evaluations are based on dimensional comparisons (e.g., how my accomplishments in one domain compare with my accomplishments in another domain) as well as the more traditional social and temporal comparisons, and on other sources of information about one's accomplishments. Extending the traditional tests of the I/E model, DCT predicts strong contrast effects only for contrasting domains that are at the opposite ends of the theoretical continuum of academic self-concept (far comparisons: e.g., the negative effect of math achievement on verbal self-concept), but much weaker negative contrast or even positive assimilation effects for complementary domains that are close to each other (near domains: e.g., positive effects of math achievement on physics self-concept; positive effects of native language on foreign language self-concept). Here we illustrate new predictions, theoretical insights, and methodology associated with DCT based on multiple academic domains (native language, foreign language, history, biology, physics and math), showing significant contrast effects for far comparisons and significantly less contrast or assimilation effects for near domains.

Self-concept, one of the oldest constructs in psychology, is a major focus in many disciplines, an important mediating factor that facilitates the attainment of other desirable outcomes, and is central to the positive psychology revolution, which focuses on how healthy, normal, and exceptional individuals can get the most from life (e.g., Diener, 2000; Marsh & Craven, 2006; Seligman & Csikszentmihalyi, 2000). Particularly in education settings, a positive academic self-concept (ASC) is both a highly desirable goal and a means of facilitating subsequent academic achievement, academic accomplishments, and educational choice behaviors, including subject choice, coursework selection, academic persistence, and long-term educational attainment (e.g., Chen, Yeh, Hwang, & Lin, 2013; Guay, Larose, & Boivin, 2004; Marsh, 1991, 2007; Marsh & Craven, 2006; Pinxten, De Fraine, Van Damme, & D'Haenens, 2010). Thus, Marsh and Yeung (1997; also see Parker et al., 2012) found that ASCs predicted future coursework selection better than corresponding measures of academic achievement, whilst Marsh and O'Mara (2008, 2010) found that ASCs predicted long-term educational attainment five years after high school graduation better than school grades, IQ, standardized tests, or socio-economic status.

In the last 30 years self-concept research has experienced dramatic growth in the quality of measurement instruments, theoretical models, quantitative methodology, and research design. The cornerstone of this resurgence is the classic review article by Shavelson, Hubner, and Stanton (1976), who posited self-concept as a multidimensional, hierarchical construct, where different facets

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of academic self-concept are substantially correlated and form a single higher-order academic self-concept factor. This is consistent with the positive relations routinely observed among achievements in different school subjects (Marsh, 2007). However, subsequent research revealed that mathematics self-concept and verbal self-concept in particular were nearly uncorrelated; this led to the Marsh/Shavelson revision (Marsh & Shavelson, 1985). Marsh and Shavelson posited two higher-order academic self-concept factors (mathematics/academic and verbal/academic), a continuum of core academic self-concept factors ranging from verbal self-concept at one end to math self-concept at the other end, and an ordering of academic self-concepts in other domains along this continuum. This perspective has resulted in increased attention to frame of reference effects based on dimensional comparisons, which are the focus of the present investigation.

Since at least the time of William James (1890/1963), psychologists have realized that self-concepts are based in part on evaluations of objective achievements in relation to frames of reference. Depending on the frame of reference, or the standard of comparison against which individuals evaluate themselves, the same objective accomplishment can lead to quite different self-concepts. Self-concepts have important consequences for future choices, for behavior and performance. In the broader psychological literature, the two most frequently posited frames of reference are social and temporal comparisons (Albert, 1977; Festinger, 1954; Möller, 2005; Möller, Pohlmann, Köller, & Marsh, 2009; Möller, Retelsdorf, Köller, & Marsh, 2011); self-concepts are based in part on how our current accomplishments compare with past performances (temporal comparisons) and on how they compare with the accomplishments of others within the current context (social comparisons; e.g., classmates in one's school or class). However, as emphasized by Möller and Marsh (2013, p. 1) in their empirical and theoretical foundation for dimensional comparison theory (DCT): "In addition to social comparisons (Festinger, 1954) and temporal comparisons (Albert, 1977), dimensional comparisons are presented as a largely neglected but influential process in self-evaluation."

Möller and Marsh (2013) stress that the internal/external frame of reference (I/E) model that forms the theoretical and empirical basis of the DCT has been studied widely only in educational settings, and mostly in relation to the math and verbal domains. DCT (Marsh et al., in press; Möller & Marsh, 2013) incorporates an extensive body of educational research based on the I/E model, placing dimensional comparisons into a broader theoretical foundation, in relation to more general psychological models of self-evaluation, person perception, frames of reference, and social comparison. Hence, the overarching purpose of the present investigation is to provide new empirical support for the extension of the I/E model into DCT.

1. The internal/external frame of reference (I/E) model and Dimensional Comparison Theory (DCT)

1.1. The internal/external frame of reference (I/E): theoretical basis and empirical support

Initially, the I/E model was developed to explain why math self-concept and verbal self-concept are nearly uncorrelated, even though achievement in the same areas are strongly correlated (typically 0.5 to 0.8, depending on how achievement is measured; for further discussion, see Marsh, 1986, 2007). This finding led to the Marsh/Shavelson revision of the original Shavelson model. In addition to this theoretical advance, it also had practical implications for the processes underlying the formation of academic self-concept in different domains and how they are related to accomplishments in these domains.

The I/E model posits that academic self-concept (ASC) in a particular school subject is formed in relation to two frames of reference: a) an external (social comparison) reference, in which students contrast their perceived performances in a particular school subject with the perceived performances of their peers in the same school subject, and b) an internal (dimensional or ipsative comparison) reference in which students contrast their own performances in one particular school subject against their performances in different school subjects. Tests of the I/E model typically are conducted by regressing math self-concept and verbal self-concept on math and verbal achievements (see Fig. 1A). The external comparison process predicts that good math skills lead to higher math self-concepts and that good verbal skills lead to higher verbal self-concepts. According to the internal dimensional comparison process, however, good math skills lead to lower verbal self-concepts, once the positive effects of good verbal skills are controlled: The better I am at mathematics, the poorer I am at verbal subjects, relative to my good math skills. Similarly, better verbal skills lead to lower math self-concepts once the positive effects of good math skills are controlled. In models used to test these predictions (see Fig. 1A), the horizontal (matching) paths leading from math achievement to math self-concept and from verbal achievement to verbal self-concept are predicted to be substantially positive. However, the cross-paths leading from math achievement to verbal self-concept and from verbal achievement to math self-concept (the gray lines in Fig. 1A) are predicted to be negative.

In reviewing the literature, Möller et al. (2009; also see Marsh, 2007; Möller & Marsh, 2013) note that evidence in favor of this model for math and verbal domains comes from diverse sources and experimental designs. Marsh (1986) first proposed the I/E model based on results from 13 studies of the relations between math and verbal achievements and ASCs in the corresponding domains. Although there were consistently high correlations between math and verbal achievements (.42−.94), there were weak or even negative correlations between math self-concepts and verbal self-concepts (−.10 to .19). In the I/E path diagram (Fig. 1A), the (horizontal) paths from math achievement to math self-concept and from verbal achievement to verbal self-concept were substantial and positive. However, the cross-paths (Fig. 1A) from math achievement to verbal self-concept and from verbal achievement to math self-concept were significant and negative. In a large cross-cultural study, Marsh and Hau (2004; also see Marsh, Hau, Artelt, Baumert, & Peschar, 2006) demonstrated that support for these predictions generalized over large, nationally representative samples of 15-year-olds from 26 countries. In a meta-analysis of 69 datasets Möller et al. (2009) reported that math and verbal achievements were highly correlated (.67), but that self-concepts were nearly uncorrelated (.10). The horizontal paths from achievement to ASC in the matching domains were positive (.61 for math, .49 for verbal), but cross-paths were negative from math achievement to verbal self-concept (−.21) and verbal achievement to math self-concept (−.27). Thus, strong support for the classical I/E predictions in relation to the math and verbal domains, generalizes over different measures of achievement, over self-concept instruments, and over age, gender, and country.

Möller and colleagues (e.g., Möller, 2005; Möller & Köller, 2001a, 2001b; Möller & Savyon, 2003; Pohlmann & Möller, 2009) provided stronger tests of causal mechanisms posited in the I/E model, based on true random control trials. They experimentally manipulated the external (social) comparison process, based on performance feedback relative to other students, and the dimensional comparison process, based on feedback relative to performance by the same student on achievement from two subject-