



Theoretical Analysis

Dimensional comparison theory: an extension of the internal/external frame of reference effect on academic self-concept formation



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ABSTRACT

In a comprehensive study (15,356 Dutch 9th grade students from 651 classes in 95 schools) we empirically tested the dimensional comparison theory (DCT) propositions formulated by Möller & Marsh (2013) as an extension of I/E theory, exploring methodological, theoretical, and substantive insights. According to DCT, academic self-concepts (ASC) are formed in relation to dimensional comparisons in different school subjects, as well as to social and temporal comparisons. In support of DCT predictions, paths from achievement to ASC in matching domains were substantially positive, but paths to non-matching domains (e.g., math achievement to verbal self-concept) were significantly negative. Extending DCT, we show that the more dissimilar the subjects, the more negative the cross paths (far comparisons), whereas cross paths relating more similar subjects (near comparisons) are much less negative and sometimes positive. Extending previous self-concept research and its integration with DCT, we found that positive paths for matching domains and negative paths for non-matching domains were larger for class marks based on classroom performance than for standardized test scores. Controlling for direct measures of social comparison (meVclass ratings of how each student compares to classmates) substantially reduced positive paths from achievement to ASC in matching domains, but also reduced the size of the negative paths from non-matching domains. Supplemental analyses suggest that dimensional comparison processes in both subjective rankings and actual class marks are consistent with those found in ASCs.

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1. Dimensional comparison theory: an extension of the internal/external frame of reference effect on academic self-concept formation

Self-concept is one of the oldest constructs in psychology, a major focus in many disciplines, and an important mediating factor that facilitates the attainment of various desirable outcomes aside from positive self-concept itself (Marsh, 2007). In educational 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 such as subject choice, coursework selection, academic persistence, and

long-term educational attainment (e.g., Chen, Yeh, Hwang, & Lin, 2013; Guay, Larose, & Boivin, 2004; Marsh, 1991; Pinxten, De Fraine, Van Damme, & D'Haenens, 2010; Parker, Marsh, Ciarrochi, Marshall, & Abduljabbar, 2013). Theoretical models of ASC formation underscore the importance of frames of reference (Marsh, 2007): The same objective achievements can lead to highly different self-concepts, depending on the standards of comparison or frames of reference that individuals use to evaluate themselves, and can have important implications for future choices, performance, and behaviors.

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-perceptions are based in part on how current accomplishments compare with past performances (temporal comparisons) and how they compare with the accomplishments of others in one's immediate context (social comparisons; e.g., classmates in one's school or class). However, in their theoretical founding of dimensional comparison theory (DCT), Möller and Marsh (2013) emphasize that: "Although social comparison (Festinger, 1954) and temporal

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comparison (Albert, 1977) theories are well established, dimensional comparison is a largely neglected yet influential process in self-evaluation" (p. 544). DCT (Marsh et al., 2014; Möller & Marsh, 2013) incorporates the extensive body of educational psychology 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. In one of the first empirical studies based on the newly expanded DCT, the objectives of the present investigation are to provide:

1. empirical research specifically designed to test new theoretical predictions based on DCT and its extension of the classic I/E model;
2. the integration into DCT of existing self-concept research and new theoretical predictions about the distinct predictive effects of class marks (i.e., school grades on report cards) and standardized test scores on ASC; and
3. new applications of meVclass ratings (how my achievement compares with those of others in my class, globally and in specific school subjects), proposed by Huguet et al. (2009) as pure measures of social comparison into DCT, thereby more clearly separating the social and dimensional comparison predictive effects that are central to DCT.

2. Dimensional comparison theory (DCT): extension of the internal/external frame of reference (I/E) model

2.1. Theoretical basis of the original I/E model

The I/E model (Marsh, 1986) was originally developed to provide a theoretical basis to explain why math and verbal ASCs (MSC and VSC) are almost uncorrelated, even though academic achievements in the corresponding areas are substantially correlated (for further discussion, see Marsh, 2007). The theoretical processes posited in the I/E model are that ASC in a particular school subject is formed in relation to an external (social comparison) reference in which students compare their perceptions of their own performances in a particular school subject with the performances of other students in the same school subject, and an internal (dimensional, ipsative comparison) reference in which students compare their own performance in one school subject with their own performances in other school subjects. Thus, students may have a favorable MSC if math is their best subject, even though they are not particularly good at math relative to other students. The joint operation of these theoretical processes, depending on the relative weight given to each, is consistent with the near-zero correlation between MSC and VSC, which led to the revision of the Shavelson, Hubner, and Stanton (1976) multidimensional, hierarchical model of self-concept (see Marsh, 2007).

In empirical tests of theoretical predictions based on the I/E model (Marsh, 1986), MSC and VSC are regressed on math and verbal achievements (see Fig. 1A). Theoretically, the external comparison process predicts that good math skills lead to higher MSCs and that good verbal skills lead to higher VSCs. According to the internal dimensional comparison process, however, good math skills lead to lower VSCs 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 MSCs once the positive effects of good math skills are controlled. In models used to test these theoretical predictions (see Fig. 1A), the horizontal paths leading from math achievement to MSC and from verbal achievement to VSC (matching paths) are predicted to be substantially positive, but the cross paths leading from

math achievement to VSC and from verbal achievement to MSC (Fig. 1) are predicted to be negative.

In a large cross-cultural study, Marsh and colleagues (Marsh & Hau, 2004; Marsh, Hau, Artelt, Baumert, & Peschar, 2006) demonstrated that support for these theoretical predictions generalized over large, nationally representative samples of 15-year-olds from 26 countries. In a meta-analysis of 69 data sets Möller, Pohlmann, et al. (2009) reported that math and verbal achievements were highly correlated (.67), but 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 VSC (−.21) and verbal achievement to MSC (−.27). Strong support for the generalizability of the I/E predictions led these authors to conclude, "The results of our meta-analyses indicate that the relations described in the classical I/E model are not restricted to a particular achievement or self-concept measure or to specific age groups, gender groups, or countries" (p. 1157), making it one of the most robust empirical findings in educational psychology research.

Providing stronger tests of causal mechanisms posited in the theoretical I/E model, Möller and colleagues (e.g., Möller, 2005; Möller & Köller, 2001a, 2001b; Möller & Savyon, 2003; Pohlmann & Möller, 2009) 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 performances by the same student on two subject-specific tasks. These true experimental studies provided strong support for causal interpretations of both the dimensional and the social comparison processes posited in the I/E model. In two introspective diary studies, Möller and Husemann (2006) also confirmed that students spontaneously carry out dimensional comparisons in everyday life, with negative (contrast) effects from one domain to self-evaluations and emotions in the other.

The I/E model has also been heuristic in relation to other major theoretical models in educational psychology. For example, Pekrun (2006; see also Goetz, Cronjaeger, Frenzel, Lüdtke, & Hall, 2010; Goetz, Frenzel, Hall & Pekrun, 2008; Goetz, Frenzel, Pekrun & Hall, 2006) has demonstrated that theoretical predictions based on the I/E for self-concept responses also generalize to emotional responses, and has incorporated the I/E model into his control-value theory of achievement emotions. Similarly, Eccles and colleagues (Eccles, Vida, & Barber, 2004; Nagy et al., 2008; Parker et al., 2012) integrated support for I/E predictions into expectancy-value theory for the prediction of gender differences in academic and career choice.

2.2. Dimensional comparison theory (DCT)

The current investigation is the first empirical test of a recently published theoretical account of DCT (Möller & Marsh, 2013; see also Marsh et al., 2013) and places the I/E model in a much broader, more general framework. Here we focus on three new theoretical contributions.

2.2.1. Near vs. far comparisons

Empirical support for the classic I/E model (Fig. 1A) is based mainly on math and verbal domains, so that there are only "horizontal" paths between matching domains and "cross" paths between non-matching domains. Although several I/E studies have considered additional domains (e.g., Bong, 1998; Marsh, Kong, & Hau, 2001; Marsh & Yeung, 2001; Möller, Streblow, Pohlmann, & Köller, 2006; Xu et al., 2013), none of these was based on the new theoretical DCT framework, which incorporates domains other than the math and verbal domains emphasized in the classic I/E model (Fig. 1B). Hence, a critically important theoretical contribution of DCT is its expansion of the scope of the theoretical perspective to include a

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