The role of peer groups in adolescent students’ academic self-concept and math performance

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Abstract
This paper reports a longitudinal study on math performance and academic self-concept on student and peer group level. Adolescent students (N=1,152) were followed up from the end of compulsory education to secondary education. Preliminary results indicate that a reciprocal relationship exists between academic self-concept and math performance on student level. Multilevel structural equation modelling will be used to examine if peer group achievement has a negative effect on student-level academic self-concept, as is the case with school level achievement and student-level academic self-concept (the-big-fish-little-pond-effect). Furthermore, prior research has found that academic self-concept mediate the relationship between perceptions of friends’ academic behaviors and academic performance. This study aims to advance the current knowledge base by examining the mediating role of academic self-concept between friend’s actual academic behavior and student academic performance. This will expand our understanding on how peer groups affect adolescent students math performance, and if this relationship is mediated by academic self-concept.

Extended summary

Introduction
Mathematics is an important skill in everyday life. Students’ mathematics achievement and positive self-concept are quality indicators of work-force preparation in the global marketplace (Evans, 2005). Students’ self-perceptions of their competence or ability are at the core of several psychological theories aimed at explain learning gains and achievement-related choices. Academic self-concept is defined as mental representations of one’s abilities in academic domains (Marsh & Craven, 1997). Academic self-concept has been found to be highly related to achievement, even after controlling for prior achievement (Eccles, Wigfield, Harold, & Blumfeld, 1993; Trautwein, Ludtke, Köller, & Baumert, 2006). There is also convincing evidence that student-level achievement has a positive effect, and school-average achievement has a negative effect (the-big-fish-little-pond-effect, BFLPE) on student-level academic self-concept (Marsh, 1987; Nagengast & Marsh, 2011). The adolescent peer environment is a multilevel, multifaceted environment that includes three main types of peer interactions: dyads (individual relationships), cliques (small groups of peers who regularly interact with each other), and crowds (adolescents who share the same reputation, but who may not necessarily interact with each other (Brown, 2004; Rubin et al., 2006). As noted earlier, extensive research has been done on how school-average achievement (crowds) affects student-level academic self-concept but less is known if the same relationship exists between peer groups (cliques) and academic self-concept.
Aims
The main aim of this study is to examine the role of peer groups in adolescent students’ academic self-concept and math performance. More specifically we will test: 1) if peer group math performance (time point 1) has a negative effect on student-level academic self-concept (T2) (i.e. BFLPE), when controlling for student-level math performance 2) a mediation model were student level academic self-concept (T1) mediates the relationship between peer group math performance (T1) and student level math performance (T2) controlling for prior student level math performance (T1).

Methodology
Participants. The participants in this study were 1,152 (576 girls, 576 boys) Swedish-speaking students. All students were measured at the end of ninth grade (mean age=15.8 years, SD=4.9). The follow-up took place two years later when the students attended either vocational (N=471) or upper secondary (N=680) education (mean age=17.9 years, SD=4.9). Of the original sample of 1,152 students, 748 participated in the second data collection.

Methods of data collection. Students’ Mathematical performance was assessed with the KTLT-test (Räsänen & Leino, 2005), which is a standardized test for grades 7-9 (13-16 years). The test identifies students with difficulties in basic mathematics and difficulties in applying these abilities in a context. A low score in the test indicate low achievement in mathematics. The test consists of 40 tasks. The test is a paper and pencil test and the students have 40 minutes to do the test. The reliability estimate of the mathematical achievement test at T1 was 0.89, and 0.92 at T2. Academic self-concept was measured with items from the Perceived Competence Scale for Children (Harter, 1982), loading on the academic self-concept subscale (8 items). The reliability estimate for the academic self-concept subscale at T1 was 0.84, and 0.84 at T2. In the third data collection participants’ peer groups in grade 9 will be identified by using a socio-metric procedure developed by Coie, Dodge, and Coppotelli (1982). The participants will be asked to nominate up to three classmates within their school (retrospectively) with whom they most liked to spend time in grade 9 (T1).

Procedure. The present study is part of a longitudinal study following the students over a period of five years. The first data collection was performed by the researchers and trained research assistants who conducted the measurements with groups of students in their own schools during ordinary lessons. The second data collection was performed by trained research assistants who conducted the measurements with groups of students after school. The third data collection (January-February 2013) will be conducted in two steps; first, participants will be contacted by phone and asked to answer questions concerning friends and current life situation. In the second step those who gave their e-mail in the phone interview get an electronic survey with measures of self-concept (Harter). In this study we will use information concerning students’ peer group from the third data collection.

Findings
The math performance and academic self-concept constructs show strong longitudinal measurement invariance, which is a prerequisite for meaningful comparisons over time. The preliminary structural equation modelling with student level data from the first two measurements show that student level academic self-concept (T1) predicts
later math performance (T2) in secondary education ($\beta = .12, p<.001$) even when controlling for math performance (T1) ($\beta = .86, p<.001$). $\chi^2(14)=23.430, p=.0536$, CFI=997, TLI=.994, RMSEA=.024. In NORSMA 2013 we will present results based on longitudinal data on student and peer group level with two measurement points by using multilevel structural equation modelling.

**Theoretical and Educational Significance**

In comparison to existent research literature this study examines the relationship between peer groups (cliques) and adolescent students’ academic self-concept and math performance. We already know that school-average performance has a negative effect on student-level achievement, which for example speak against tracking of students into different schools based on performance. This study will add to our knowledge if they same effects can be found between peer groups achievement and student-level academic self-concept. Prior research has found that academic self-concept mediate the relationship between perceptions of friends’ academic behaviors and academic performance (Jones, Audley-Piotrowski, & Kiefer, 2012). This study will add to our knowledge if the same holds for friends’ actual academic behavior using a multilevel longitudinal design. This expands our understanding of the effects which peer groups have on adolescents’ math performance, and if this relationship is mediated by academic self-concept.

**References**


