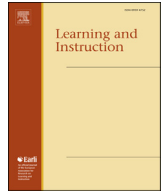




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## Learning and Instruction

journal homepage: [www.elsevier.com/locate/learninstruc](http://www.elsevier.com/locate/learninstruc)

# Girls get smart, boys get smug: Historical changes in gender differences in math, literacy, and academic social comparison and achievement

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## ARTICLE INFO

## Article history:

Received 7 September 2016

Received in revised form

21 August 2017

Accepted 2 September 2017

Available online xxx

## Keywords:

Gender differences

Self-concept

Social comparison

Assimilation

Contrast

## ABSTRACT

Girls' lack of self-belief has frequently been cited as a major barrier to advancement in both empirical research and in the popular imagination. With girls now outcompeting boys at almost every educational level, this paper considers if girls still have lower self-concept than boys, if this changes when controlling for academic ability, and what mechanisms explain gender differences. We compare and contrast rational choice, contrast, and assimilation approaches to self-concept and juxtapose historical trajectories in gender differences in self-concept and achievement to distinguish between them. We do this in five age cohorts born between 1981 and 1993 ( $N = 66,522$ ) for math, literacy, and general academic domains. Results suggest that there are still significant differences in self-concept between equally able boys and girls and that a mix of assimilation and contrast mechanisms likely explains the size and direction of these effects.

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## 1. Introduction

Gender differences in human capital have largely been eliminated from the labor market (Goldin, 2014). In education, females now outperform males at most levels of education and are better represented in universities (OECD, 2015). Yet gender gaps persist in average income, and employment in prestigious occupations and leadership roles (CEDA, 2013; Goldin, 2014). There are a variety of reasons why this may be the case including both structural issues and differences in non-cognitive factors (Chevalier & Arnaud, 2007; Goldin, 2014). Both academic research (Hyde, 2014; Phelan, Moss-Racusin, & Rudman, 2008; Rudman, 1998) and the media (Duberman, 2014; League, 2011) have highlighted a reason of particular relevance – self-concept and self-promotion. Indeed, cross-cultural and developmental research has demonstrated a relatively stable moderate self-esteem advantage for men of about 0.25 of a standard deviation (Bleidorn et al., 2015) while also suggesting that women not only have more negative general self-concept but can also be socially penalised for overt displays of confidence (Phelan et al., 2008).

It is natural to ask then, does this difference in self-concept have its origin in schooling and, if so, how has this difference responded to historical increases in human capital and the educational attainment of women from the preceding decades? This is certainly not the first research to consider self-concept in education as a central explanatory variable in gender differences in long-term outcomes. Indeed, the most recent Organisation for Economic Co-operation and Development (OECD, 2015) report on gender differences discusses such beliefs as the central non-cognitive factor in explaining gendered outcomes in math and science domains internationally. However, our focus is on historical trends in differences in self-concept conditioned on achievement (i.e., of equally able boys and girls) and how these trends are related to trends in gender gaps in achievement. As such, we aim to: a) describe the historical trends in gender gaps for adolescents over a historical period of more than a decade, b) identify particular mechanisms that may be relevant to these differences, c) address how such mechanisms may work together, and c) consider whether historical trends support a particular mechanism or combination of mechanisms. Below, we outline the advantages of using historical data, present competing theoretical mechanisms for how gender differences may emerge in self-concept, and provide a review of the literature.

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### 1.1. The use of historical data

There is a considerable literature on gender differences in self-concept (see Hyde, 2014 for a review). However, little research has specifically focused on gender differences in self-concept controlling for academic achievement (i.e., the portion of self-concept differences that would seem incompatible with objective reality). Although some research on this exists (e.g., Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002), this mostly represents single cohort longitudinal or cross-sectional research that is ill placed to determine the mechanisms behind such gender differences. This is partly due to a lack of explanation of the various competing theoretical arguments, which we specify in detail here. Even so, showing a gender difference from a single sample in a survey design rarely provides sufficient information to choose between competing mechanisms even if various mechanisms are specified. In order to do this, several options are available to researchers, each with their own strengths and weaknesses.

The first method of comparing mechanisms is experimental with the random assignment of participants. This method is often seen as the gold standard due to its unrivalled ability to provide evidence of causation. However, experimental research in this area often suffers from low power and a lack of external validity (Flore & Wicherts, 2015; Ganley, Mingle, Ryan, Ryan & Vasilyeva, 2013). A second approach is the use of comparative data from multiple countries (e.g., Charles, Harr, Cech, & Hendley, 2014; Else-Quest, Hyde, & Linn, 2010; Mann & Di Prete, 2016; Skaalvik, 1990; Stoet, Bailey, Moore, & Geary, 2016). Variation in achievement or gender inequality indexes or other factors at the country level can be correlated with gender differences in self-concept and these results compared against what would be expected on the basis of different theoretical mechanisms. However, countries often differ from each other in a vast number of ways (e.g., response set differences, latent cultural differences, etc.) that make it difficult to determine what factors are driving variation in results.

Finally, historical data provides evidence for or against competing mechanisms (e.g., Schoon, 2006). While not so common in educational psychology, this approach is often undertaken in life course studies (e.g., Bynner, 2016; cf.; Cimpian, Lubienski, Timmer, Makowski, & Miller, 2016). Its advantage is that cohorts are inherently ordered in time allowing for the construction of trajectories of historical change in multiple relevant variables. This is particularly useful where several counteracting mechanisms may be at work. In particular, where a single set of results may seem to favour only one mechanism, careful attention to historical changes can reveal that such results may actually be due to a mix of competing mechanisms of differing strength. This is particularly the case where historical trends include notable changes in context that can be used as a natural experiment (Bronfenbrenner, 1979). As noted above, one of the most notable changes in the educational context has been the increasing performance of women. Thus research, such as the present, can provide an indication of how self-concept is likely to change in response to an intervention that targets closing any remaining gender gaps in achievement.

Furthermore, the presentation of historical trajectories alone often represents a useful scientific endeavour above and beyond what it may reveal about different mechanisms (see Goldthorpe, 2016). Historical data over a moderate time frame also holds constant a number of often-unmeasured variables that can reduce confidence in multi-country studies. The disadvantage is that researchers must rely on data collected by others and thus have little control over the measures, populations, or time periods covered (see Elder, Pavalko, & Clipp, 1993). Additionally, variation across short historical periods is likely to be smaller than variation across countries.

All three approaches (experimental, multi-country, and historical) have complementary strengths and weaknesses, and all are certainly stronger than one-shot cross-section studies. We contribute to the advancement of research in this area by focusing on historical data. This is of particular relevance given that one of the defining features of recent history has been the dramatic rise of female academic achievement (Goldin, 2014; OECD, 2015). Yet little research has mapped the rise in achievement with change in self-concept, and certainly no research has done so with comparable databases explored over a decade. We aim to present evidence of trajectories in gender differences in academic achievement, self-concept, and self-concept controlling for achievement in math, English, and general academic domains. Below, we outline several theories on what such trajectories might look like if particular mechanisms were in operation.

### 1.2. Self-concept theories

Self-concepts are of interest in multiple fields of the social sciences, each with different approaches, and each, based on the number and strength of the assumptions that they hold, more or less likely to be true a-priori. We discuss these theories from simplest (fewest assumptions) to most complex.

#### 1.2.1. Rational action theories of self-concept

The simplest models are those that suppose that individuals are rational actors (Little, 2012). This economic based approach has only three assumptions: 1) individuals have stable preferences, 2) individuals aim to maximise their utility with respect to those preferences, and 3) individuals do so under resource and/or information constraints (Becker, 1974). From these three assumptions a compelling model of self-concept can be built. We start with the assumption that people have a stable preference for accurately knowing their position relative to others (i.e., ability self-concept) and seek to maximise the accuracy of their self-concept by forming them with the best available information. However, accurate and objective information can be difficult and costly to obtain. As such, individuals will only seek to maximise the objectivity of their self-concept as long as the cost of gaining access to more objective information outweighs the benefits received from the increased accuracy of their self-concept.

The clearest application of this approach to self-concept is by the sociologist John Goldthorpe (2007; Breen & Goldthorpe, 1997) who saw self-concept as a function of achievement and thus group differences by social class or gender as purely a function of differences in underlying achievement distributions. Any group differences beyond achievement were thought to be ephemeral in nature and would quickly be resolved by students continuing to receive feedback by way of additional test scores and other information over the course of their school careers (Goldthorpe, 2007). Such rational choice theories are often seen sceptically within psychology, however, it must be noted that they do have the benefit of being self-contained explanations and of having relatively few assumptions (i.e., that people do what is best for them with the resources that they have to hand is its own explanation) (see Becker, 1974; Goldthorpe, 2007; Little, 2012). For our purposes, this theoretical approach would hypothesise that, after controlling for academic ability, there would be no difference in self-concept by gender, or at least no systematic difference, and that this would remain the case regardless of how large gender differences in achievement became over time, or which gender such achievement differences favoured.

#### 1.2.2. Contrast theories of self-concept

A more modest proposal (which decreases the requirement for

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