International Journal of Educational Research 58 (2013) 79–96

Contents lists available at SciVerse ScienceDirect

International Journal of Educational Research

journal homepage: www.elsevier.com/locate/ijedures

Predicting achievement: Confidence vs self-efficacy, anxiety, and self-concept in Confucian and European countries

Suzanne Morony [a], Sabina Kleitman [b], Yim Ping Lee [a], Lazar Stankov [a,c,*]

[a] National Institute of Education, Singapore
[b] The University of Sydney, Australia
[c] University of Western Sydney, Australia

ARTICLE INFO

Article history:
Received 11 July 2012
Received in revised form 21 November 2012
Accepted 23 November 2012
Available online 29 December 2012

Keywords:
Self-efficacy
Self-concept
Confidence
Metacognitive beliefs
Mathematics achievement

ABSTRACT

This study investigates the structure and cross-cultural (in)variance of mathematical self-beliefs in relation to mathematics achievement in two world regions: Confucian Asia (Singapore, South Korea, Hong Kong and Taiwan) and Europe (Denmark, The Netherlands, Finland, Serbia and Latvia). This is done both pan-culturally and at a multigroup-level, employing multiple regression analysis and structural equation modeling on a sample of 7167 students (modal age 15.1) from nine countries in Confucian Asia and Europe. As expected, Confucian Asian countries were lower on self-concept and higher on math anxiety than European countries. In contrast, confidence, a relatively new measure of self-belief, shows little difference between regions, yet is the single most important predictor of math accuracy both within each country and pan-culturally. It accounts for most of the variance explained by the other self-constructs combined, has excellent psychometric properties, and is simple to administer. Self-efficacy adds only a very small amount of incremental validity when confidence is in the equation. There are significant differences between the two world regions in terms of calibration – Europeans are more overconfident – due to lower overall mathematics scores of students from Serbia and Latvia.

1. Introduction

Two lines of educational research point to the importance of self-beliefs in education. First, Lee (2009) and Lee and Stankov (submitted for publication) analyzed the non-cognitive variables assessed by the Programme for International School Assessment (PISA) in 2003. They showed that three mathematical self-belief constructs – self-efficacy, self-concept and anxiety – are the best non-cognitive predictors of individual achievement in mathematics. Together these three account for approximately 16% of the variance in mathematics achievement – better than twelve different measures of motivation, learning strategies and attitudes to school (Lee & Stankov, submitted for publication). At the between-country level, Lee (2009) also showed that although Confucian Asians have the highest mathematics achievement scores among all 41 PISA 2003 countries, they tend to be ranked at the bottom on measures of self-efficacy and self-concept (collectively referred to as self-doubt) and correspondingly high on anxiety.

* Corresponding author at: Centre for Positive Psychology and Education, University of Western Sydney, Bankstown Campus, Locked Bag 1797, Penrith South, NSW 2751, Australia. Tel.: +61 2 9772 6259; fax: +61 2 9772 6432.
E-mail addresses: lazondi@rocketmail.com, l.stankov@uws.edu.au (L. Stankov).

0883-0355/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ijer.2012.11.002

More recently, two independent studies based on large samples of Secondary 3 (mean age ~15 years) students from Singapore measured mathematics achievement in relation to a range of non-cognitive variables including motivation and personality, and also found self-belief constructs to be the best predictors of achievement. These studies both added a measure of post-item confidence that has a long history in psychology but had not been included in previous large-scale educational studies. This proved to be the strongest predictor in each case (Stankov, Lee, Luo, & Hogan, 2012; Stankov, Morony, & Lee, in press). In both studies confidence alone accounted for the major part of variance explained by the self-beliefs, with self-efficacy and anxiety combined accounting for only 1%, and self-concept itself capturing a miniscule amount of incremental variance.

The present paper combines these two lines of research on non-cognitive variables, to determine whether measures of confidence add comparable incremental validity over the aforementioned three self-belief constructs in an international sample.

1.1. Self-belief constructs

There has been considerable debate concerning the definitions, specificity, and overlap between the different self-belief constructs mentioned above (see e.g. Bong & Skaalvik, 2003; Ferla, Valcke, & Cai, 2009). We take the view that although there is considerable overlap between the constructs, they are conceptually and empirically distinct (Lee & Stankov, submitted for publication). We briefly review these constructs below.

1.1.1. Self-efficacy

Self-efficacy is defined as a person's belief in their ability to bring about desired specific outcomes (Bandura, 1997). According to Bandura (1997) "A self-efficacy assessment ... includes both an affirmation of a capability level and the strength of that belief" (p. 282). According to Pajares (1996) it can be measured on a broad or on an item-specific level; however, self-efficacy judgments that are more item-specific have more predictive power (Chen & Zimmerman, 2007). Thus self-efficacy measures tend to be domain-specific (see Bandura, 2006 for guidelines on scale development) and participants are not asked to compare themselves with others (Bandura, 1997; Bong & Skaalvik, 2003; Pajares, 1996). For example, in PISA 2003 students were presented a series of hypothetical mathematics-related items (e.g. "calculate the number of tiles needed to cover a floor") and asked "how confident are you that you could solve this (type of problem)". According to Bandura (1993, 1997), self-efficacy (or confidence to attain future outcomes) predicts choice of activity, effort expenditure, thought patterns (such as dwelling on negative outcomes) and emotional reactions such as stress and depression.

1.1.2. Self-concept

Self-concept is positively correlated with self-efficacy, and reflects a more general sense of how well a person thinks she/he performs at a school subject or set of tasks. Measures of self-concept reflect a student's self-comparison to his or her immediate peers (i.e., frames of reference) and involve cognitive and affective evaluations of the self (Bong & Skaalvik, 2003; Marsh, 1992; Schunk & Pajares, 2005). The normative qualities of self-concept measures were highlighted in PISA 2003 (Lee, 2009; OECD, 2004) and subsequent large-scale international studies, in which some of the highest-performing (i.e., Japanese and Korean) students in the world expressed the lowest self-concept for mathematics, and some lower-performing countries had overall very high self-concept – the so-called "Big Fish Little Pond Effect" (see Marsh, 1992).

While mathematics self-concept directly targets feelings of competence regarding the subject discipline of mathematics, self-concept can also be measured in relation to critical skills underlying mathematics competence – namely memory and reasoning. The MARCI (Memory and Reasoning Competence Inventory; see Kleitman & Stankov, 2007) measures self-concept about memory and reasoning abilities. To the extent that these abilities are relevant for performance on tests of mathematics, MARCI and self-concept in mathematics should be related.

1.1.3. Anxiety

Self-efficacy and self-concept in their negative form (collectively, self-doubt) are highly related to anxiety, which refers to one's physiological and affective responses when performing or thinking about a task. Mathematics anxiety can be thought of as a domain-specific anxiety related to, or directed toward, mathematics. Several mechanisms have been postulated for the negative relationship between mathematics anxiety and mathematics self-concept and self-efficacy. Firstly, students who find mathematics anxiety-producing may seek to avoid those negative feelings by avoiding mathematics, thereby avoiding the practice needed to achieve mastery. Second, those who are already struggling with mathematics will find it less enjoyable than those who are able to master it. Third, the anxious feelings use up working memory capacity, leaving fewer resources for anxious students to solve problems resulting in negative effects on performance. The anxious feelings will feed into self-concept (e.g., I think I am not good at mathematics).

PISA 2003 identified a high prevalence of mathematics anxiety among 15-year-olds, particularly females. Notably, students in Denmark, Sweden and the Netherlands report low levels of anxiety in mathematics, and have a high level of mathematics performance overall (Lee, 2009; OECD, 2004). As a form of validation against existing international datasets this study will also examine gender differences in anxiety and other self-beliefs.