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Measuring current achievement motivation with the QCM: Short form development and investigation of measurement invariance

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ABSTRACT

This article explores the measurement properties of the *Questionnaire on Current Motivation* (QCM; Rheinberg, Vollmeyer, & Burns, 2001), which measures four factors of current achievement motivation (anxiety, challenge, interest, and probability of success) in the context of taking an abstract reasoning test. Two studies were conducted. In study 1, the measurement model of the QCM was tested, and a short form consisting of 12 of the original 18 QCM items was derived. Data were obtained from $N = 350$ students completing the QCM in anticipation of working on a test of Latin Square Tasks. In study 2, the measurement properties of the short form were replicated with data from a sample of $N = 509$ students. Measurement invariance with respect to gender was investigated using multigroup CFA models. The results showed that the assumptions of equal numbers of factors, factor loadings, and residual variances could be confirmed, but evidence for full intercept invariance was not obtained. There were significant differences in the latent means for anxiety and probability of success between female and male test takers, but none of these two factors had an influence on actual test performance, which was instead significantly predicted by interest in the task.

1. Introduction

The motive to achieve is one of the three basic human motives in general theories of motivation (cf. McClelland, Atkinson, Clark, & Lowell, 1953; Murray, 1938). It has been linked to actual task performance in many different achievement contexts (e.g., Atkinson, 1974; Richardson & Abraham, 2009; Steinmayr & Spinath, 2008). However, a high degree of achievement motivation does not necessarily lead to accordant behavior in performance situations because the characteristics of the task at hand play an important role as well (Rheinberg et al., 2001). *Current* achievement motivation (CAM) is therefore conceptually defined as the product of an achievement motive on the person side and situational task characteristics (cf. Atkinson, 1957; Lewin, 1946). This definition takes individual differences in task preferences into account. CAM is assumed to directly influence task-related behavior in a *specific* performance situation. As such, its situational character emphasizes that it is conceptualized as a state variable.

Rheinberg and colleagues have offered a model of CAM that differentiates four distinct factors. These factors are (1) anxiety, (2) challenge, (3) interest, and (4) probability of success. Anxiety can be interpreted as fear of failure in an achievement situation (Atkinson, 1957). Anxiety in such situations results when individuals are afraid of failure even though they may have the ability to succeed. Anxiety is thus deemed to capture the negative incentive of failure. Challenge concerns the degree to which a person accepts a task as relevant. Individuals may differ with respect to the relevance they attribute to a specific task. Also, challenge is influenced by perceived task easiness. Interest is related to a person's positive affect toward and positive evaluation of a task. It mirrors the direct appeal the task elicits. Finally, probability of success implies that individuals compare their own perceived ability with the perceived difficulty of the task. If ability outweighs task difficulty, probability of success will be high, and vice versa. This factor can also be found in models of general task-motivation (e.g., Atkinson, 1957; Bandura, 1997).

With the *Questionnaire on Current Motivation* (QCM), Rheinberg et al. (2001; for an English version see Vollmeyer & Rheinberg, 2006) have introduced a self-report instrument designed for the measurement of these four CAM factors in specific performance situations. The original QCM features a total of 18 items and uses a 7-point rating scale (disagree–agree). Rheinberg and colleagues have shown the usefulness of the QCM as a predictor of performance in a variety of complex problem solving tasks (Rheinberg et al., 2001; Vollmeyer & Rheinberg, 2006). However, the

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assessment of CAM can be of interest in research and professional contexts using standard ability tests as well. In personnel selection and in many empirical studies, such tests are routinely administered. Test achievement can be significantly influenced by the degree of motivation participants show when they are confronted with such tasks. For instance, Freund and Holling (2011) investigated CAM for figural matrix items in a retest study. Test performance (accuracy and test time) on the matrices test was significantly predicted by CAM, which explained additional variance beyond GMA. Retesting increased the influence of CAM on accuracy, but not on test time. The four CAM factors were also shown to be significantly related to the Big Five and general mental ability (GMA).

So far, information on the measurement properties of CAM scores obtained with the QCM is relatively sparse. This implies that it is still unknown if the proposed measurement model provides a good fit to QCM data collected in specific performance situations. Furthermore, potential measurement bias (MB) in QCM scores has not been investigated. The existence of MB makes direct comparisons between scores of members from distinct groups difficult because MB can imply that manifest item means are substantially affected by "unwanted" covariates, for instance, subjects' gender, ethnic group membership, etc. The absence of MB is typically labeled as measurement invariance (MI). Usually, methods of confirmatory factor analysis and/or item response theory are used for the analysis of MI (cf. Reise, Widaman, & Pugh, 1993; Vandenberg & Lance, 2000).

For trait-like achievement motivation, there are many studies on gender differences, especially in the academic domain (cf. Meece, Glienke, & Burg, 2006; Steinmayr & Spinath, 2008). In a recent study, Van der Sluis, Vinkhuizen, Boomsma, and Posthuma (2010) have investigated MI in achievement motivation with respect to gender, and found some subscales on measures of academic and general achievement motivation to be biased. However, to date, there have been no studies investigating MI with respect to gender in measures of (state-like) CAM.

1.1. Aims of the present article

Since CAM has been shown to be related to performance on cognitive tasks (Freund & Holling, 2011), researchers should be interested in convenient measures in order to assess it. The QCM, as originally introduced by Rheinberg et al. (2001), is an 18 items instrument, where anxiety and interest are measured with five items each, while challenge and probability of success are measured with four items, respectively. The first goal of the present article was the investigation of the measurement properties of the QCM. Further, we aimed at the development of a QCM short form by reducing the number of items to a total of 12 (three items per factor). A questionnaire with only 12 items can be more easily incorporated into research set-ups where many tests and questionnaires have to be administered and where time is precious. In a second study, we aimed at replicating the results from the first study, investigating MI of CAM scores across gender, and analyzing the relationships between the CAM factors and task performance.

Because CAM can only be measured after introduction to a specific task, we used Latin Square Tasks (LST; Birney, Halford, & Andrews, 2006; Zeuch, Holling, & Kuhn, in press) as a measure of cognitive performance. The LST is a task type that can be constructed rationally on the basis of relational complexity theory (cf. Birney et al., 2006). It is supposed to measure the effects of reasoning ability independent of prior knowledge. LST consist of several cells containing non-meaningful symbols. One cell shows a question mark, and the examinee has to decide which symbol has to be placed into this target cell. The only rule to follow is that every symbol must occur exactly once in every row or column, respectively, and this rule remains the same for every level of complexity (Birney et al., 2006; Zeuch et al., in press; see Fig 1 for an illustration).

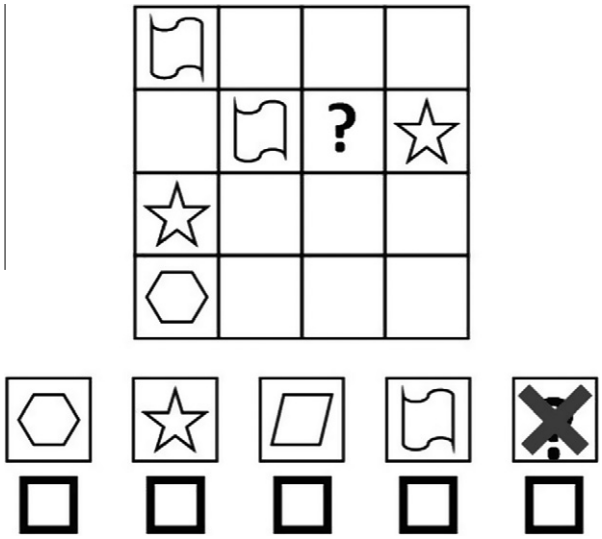

Fig. 1. Sample item of a Latin Square Task.

While CAM has been shown to contribute to understanding individual differences in matrices test performance (Freund & Holling, 2011), the use of LST in the present study was anticipated to enhance the state of knowledge on the applicability of CAM to different cognitive tasks.

2. Study 1

2.1. Materials and methods

350 undergraduate university and secondary school students participated in this study. There were 201 females and 149 males. Their age ranged from 16 to 32 years, with a mean of 18.52 and a standard deviation of 1.68.

All participants received a detailed introduction to LST by means of a booklet featuring explanatory illustrations for all task principles. While one purpose of such a thorough explanation is to ensure a complete understanding of the task type and to establish equal testing conditions for all test takers, it also allows for the assessment of CAM.

After the introduction and explanation of the LST, the QCM was administered. Anxiety, challenge, interest, and probability of success were measured on 7-point rating scales, with the labels "disagree" at 1 and "agree" at 7.

2.2. Results

We conducted confirmative factor analyses on the measurement model of the full QCM with 18 items. While estimators for categorical data are available, according to Beauducel and Herzberg (2006), these do not out-perform maximum likelihood estimates when the number of categories is sufficiently large (i.e., at least five categories), and when univariate non-normality is not excessively violated (e.g., skews and kurtoses consistently greater than 2). There were only two items with kurtosis greater than 2 (items AN2 and CH2), the range was −1.23 to +2.49, and the mean was −0.01. All skews were between −1.65 and +1.05