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Assessing creative potential as student outcome: On the applicability of the TCT-DP in repeated measures

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ABSTRACT

Within a constantly changing society, the ability to act creatively in various domains is becoming increasingly important. Schools are expected to react to this by educating their students in complex problem-solving skills and creative thinking (OECD, 2014). Teachers are therefore asked to foster creativity, which implies a need to learn more about assessing creativity or creative potential. When evaluating programs that are designed to foster creativity in and out of school, it is necessary to assess creativity as a criterion, even though this is a challenging thing to do. The difficulties become particularly apparent when it comes to investigating creativity development. The present study uses the Test for Creative Thinking-Drawing Production (Urban & Jellen, 1996) to take a closer look at the measurability of creativity during childhood. German students were tested three times while at elementary school (at the beginning of the first grade and at the end of the second and fourth grade). We tested measurement equivalence and found partially strong measurement invariance in a subset of the rating categories suggested in the test's manual. The proposed model is discussed theoretically and empirically, while keeping in mind that it is essentially a preliminary finding until replication studies have been conducted. The study indicates how creativity could be taken into account as a relevant student outcome in large-scale assessments.

1. Introduction

Measuring creativity or creativity-related constructs, such as divergent thinking, has long been a challenge for scientists working in various fields (e. g. Davis, 1989; Frederiksen & Ward, 1978; Hocevar, 1981; Kuhn & Holling, 2009a, 2009b; Lubart, Pacteau, Jacquet & Caroff, 2010; Piffer, 2012; Treffinger, 2009). Given the lack of an agreed definition of the construct, the operationalization differs according to the research question, the aim of the study and/or the researcher's field. Generally speaking, one can define creativity as the ability to produce ideas or (im) material work that are novel, original and useful, and that fulfill task requirements (Lubart, 1994). Lubart's definition is similar to the one proposed by Drevdahl, who describes creativity as the ability to produce ideas that are essentially new and to use them in a goal-directed way in order to reach an original product (Drevdahl, 1956). Drevdahl further explains that a product or idea does not necessarily have to be complete or perfect to be considered creative, which is an appropriate definition for researchers who study creativity in children. Since "a child's creativity can be quite personal" (Runco, 2003, p. 318), children cannot be expected to produce perfect or complete

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products. Consequently, when studying creativity in children, it is advisable to use an individual frame of reference that takes account of the fact that an idea might be new only to the child but not to others surrounding the child and still could be considered creative in the sense of the above mentioned definition (Stein, 1967; Urban, 1991).

Creativity is an undeniably relevant human characteristic. It is considered a key personality attribute that can affect development in various domains (Mehlhorn & Mehlhorn, 2003; Urban, 1991), and is related to cognitive functions such as intelligence (Batey, Furnham & Safiullina, 2010; Getzels & Jackson, 1962; Kim, 2005; Sparfeldt, Wirthwein & Rost, 2009; Sternberg & O'Hara, 1999), reasoning and problem solving (Guignard & Lubart, 2006; Parnes & Harding, 1962; Torrance, 1963), which in turn could affect performance at school and lifelong learning. Practitioners and researchers consider creativity to be an educational goal (Cropley, 2005; Serve, 2000; Urban, 1991; OECD, 2014) because it can help solve complex problems in any domain (Torrance, 1963). Therefore, societies as a whole benefit from creative persons as they tend to be open-minded, critical thinkers who also can have innovative ideas which can also influence economic strength of a society.

Although some educational researchers have conducted studies on creativity, it has not consistently been considered as a student outcome. Empirical studies have neglected it as a determinant of learning processes. In part, this might be due to persistent challenges in assessing creativity and to the fact that so many different definitions of the concept of creativity exist (Piffer, 2012).

Creativity is a complex construct that is affected by factors such as openness and curiosity (Batey et al., 2010; Dollinger, Urban & James, 2004; Feist, 1998; Furnham & Bachtiar, 2008), cognitive skills (see above), motivation (Amabile, 1996; Csíkszentmihályi 1996), and external influences (Amabile, 1996; Cropley, 2005; Urban, 1991; Urban, 2004a). As a result, assessing creativity as an outcome variable is an enduring challenge for researchers, especially when it comes to longitudinal studies that are designed to show creativity development. This is the starting point for the present study. Its purpose is to investigate whether creativity can be measured during elementary school while maintaining measurement invariance. Using data from more than 800 German elementary school students who were tested three times (at the beginning of the first grade, and at the end of the second and fourth grade) with a standardized procedure (Test for Creative Thinking-Drawing Production; Urban & Jellen, 1996), we investigated the levels of measurement invariance (Meredith, 1993) to establish whether creativity can be assessed invariantly. We also compared this alternative approach to measuring creativity with the traditional way of scaling the data in order to evaluate different ways of measuring creative potential in elementary school students.

2. Background

Prior research shows that creativity development is unstable with regard to 1) rank stability and 2) mean stability. When investigated using mean stability in multi-cohort designs, student creativity was typically found to decrease after school enrollment. It then increases during elementary school, but decreases again when the child enters secondary school (Krampen, Freilinger & Wilmes, 1991; Lau & Cheung, 2010; Smith & Carlsson, 1983; Torrance, 1963, 1968; Urban, 1991). This lack of continuity in creativity development is often explained by changing external circumstances (e.g. Urban, 1991). When children are enrolled in school, they enter a new phase in their lives. Starting school brings structure to their day and reduces their freedom; it also brings greater expectations in terms of their (social and learning) behavior and they must learn to accept social authorities. At first, this may cause uncertainty, which in turn hinders creativity. In addition, children tend to become less playful and more aware of the potential consequences of their behavior, which might stop them from trying out new things and expressing themselves freely (Lau & Cheung, 2010; Urban, 1991).

When creativity development was investigated using rank stability in repeated measures, only low interindividual stability was shown over periods of around two years. Test-retest correlations ranged from $r = 0.10$ to $r = 0.34$ in children of elementary school age (e.g. Heise, Böhmer & Körner, 2010; Krampen et al., 1991; Theurer, Berner & Lipowsky, 2012). Sparfeldt et al. (2009) found a stability of $r = 0.35$ between the fourth and ninth grade (for similar results see also Magnusson & Backteman, 1978). This discontinuity and low interindividual stability in creativity development highlights two things. Firstly, in order to explain the aforementioned development courses, creativity should be investigated more often in combination with theoretically relevant covariates. Secondly, care should be taken to ensure that repeated measures assess and represent the same construct in a psychometric sense, as this will increase the quality of the data and thus the quality of the information gained from longitudinal studies.

To measure change, measurement invariance (Meredith, 1993) is usually needed to ensure the equivalence of data generated by an instrument that was applied multiple times. In the case of creativity research this appears to be particularly needed, as studies show an unstable development. To examine whether these unstable developments are a consequence of measurement error, the approach of investigating measurement invariance seems suitable. Meredith (1993) proposes different levels of measurement invariance (MI) with increasing model constraints. Configural MI is the lowest level of MI and is defined as invariance in factor structures over time (or between groups). Weak MI is reached when the items also show the same factor loadings. Weak MI is a minimum requirement when investigating structural relationships (Little, Preacher, Selig & Card, 2007) because it proves the items have the same metric. Investigating the mean structure of the construct requires strong MI, as this shows that the factor structure, the factor loadings and the intercepts of the items are sufficiently comparable. Once strong MI has been reached, difference values can be generated. Strict MI is reached when the items also show the same residual variances. If restrictions are loosened at one of the levels, partial MI is said to have been reached on that particular level.