



# The developmental trends of different creative potentials in relation to children's reasoning abilities: From a cognitive theoretical perspective



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## ARTICLE INFO

### Article history:

Received 16 March 2016  
Received in revised form 14 July 2016  
Accepted 19 August 2016  
Available online 21 August 2016

### Keywords:

Developmental trend  
Open-ended creativity  
Closed-ended creativity  
Reasoning

## ABSTRACT

Previous studies that demonstrated the well-known “fourth-grade slump” phenomenon mostly adopted the divergent thinking type of creativity measures. The present study distinguishes between open-versus closed-ended creative potentials and predicts their different developmental trends and different relations to the development of children's reasoning ability. According to Piaget's cognitive development theory and the dual-process account of creativity theory, open-ended creativity is hypothesised to mainly rely on intuitive, associative Type 1 processing and could be interrupted by the development of formal operations. Closed-ended creativity, on the other hand, involves both Type 1 and Type 2 analytical, evaluative processing, and could benefit from the development of reasoning abilities. The present empirical examinations—with a longitudinal-sequential design—on the task performances of third, fourth, and fifth graders supported the hypotheses. The open-ended creativity indices (the divergent thinking test) exhibited descending trends across age, while the closed-ended creativity measures (the Chinese Word Associates Test and the insight problem-solving task for children) and reasoning abilities (thematic syllogisms) showed ascending trends. The path analysis results further demonstrated that the development of reasoning ability had a significant impact on closed-ended but not open-ended creative potential. The implications of these results and suggested future investigation issues are discussed.

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## 1. Introduction

Creativity is undoubtedly essential to both individuals' lives and human civilisation. How this ability develops is an important issue in the creativity research literature (Runco, 2007). Some researchers have inspected various factors that influence creativity development, such as affective factors, for which the involvement of emotions broadens association processes; personality factors, for which openness to experience, self-confidence, etc., have been identified as being crucial (for a review, see Russ & Fiorelli, 2010); biological factors, with creative thinking involving the prefrontal cortex, which develops across childhood and adolescence (e.g., Kleibeuker, De Dreu, & Crone, 2013); and environmental factors, including organisational or learning climates, which offer an open and trusting atmosphere and promote teamwork operation, etc., to facilitate creativity development (Preiser, 2006; Yi, Hu, Plucker, & McWilliams, 2013). In addition to all of these factors, other

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researchers have examined the developmental trajectories of creativity across childhood and/or adolescence. The present study aims to investigate this latter issue.

The early eminent work of [Torrance \(1968\)](#) demonstrated an irregular developmental trend using his Torrance Test of Creative Thinking (TTCT). The fourth-grade slump phenomenon (in which creativity rises from Grade 1 to Grade 3, with a sharp decrease in Grade 4) is particularly fascinating and has attracted many research efforts. Later studies replicated this result (e.g., [Cheung, Lau, Chan, & Wu, 2004](#); [Georgsdottir, Ameen, & Lubart, 2002](#); [Hu, Shi, Han, Wang, & Adey, 2010](#); [Lubart & Lautrey, 1996](#)), and various explanations have been proposed. However, some other studies did not find the fourth-grade slump phenomenon ([Charles & Runco, 2000–2001](#); [Yi et al., 2013](#)) but a continuously ascending trend in creativity (e.g., [Besancon & Lubart, 2008](#); [Maker, Jo, & Muammar, 2008](#)). Researchers reasoned that the inconsistencies might have stemmed from a variety of instruments and experimental tasks being used ([Maker et al., 2008](#)), and this proposal gained some empirical support ([Alfonso-Benlliure & Santos, 2016](#); [Kleibeuker et al., 2013](#)). Following this proposal, the present study distinguishes creative potentials as open-ended versus closed-ended in nature and predicts their distinct developmental trajectories in relation to reasoning abilities based on the theoretical views of [Piaget's \(1970\)](#) cognitive development theory and the “dual-process account of creativity” theory ([Lin, Hsu, Chen, & Wang, 2012](#); [Lin & Lien, 2013a](#)).

### 1.1. *Developmental trends of creativity: inconsistencies of the fourth-grade slump phenomenon*

Many explanations have been offered after the demonstration and replications of the fourth-grade slump phenomenon ([Cheung et al., 2004](#); [Georgsdottir et al., 2002](#); [Hu et al., 2010](#); [Lubart & Lautrey, 1996](#); [Torrance, 1968](#)). Some researchers stated that fourth-grade children emphasised facts and reality, and were therefore less involved in imagination ([Gardner, Phelps, & Wolf, 1990](#); [Rosenblatt & Winner, 1988](#)). According to [Kohlberg's \(1987\)](#) theory of moral development, [Runco \(2007\)](#) hypothesised that fourth-grade children were in a transition from the pre-conventional stage to the conventional stage, and stressed rules while inhibiting atypical ideas and behaviours (as hyperconventionality) in order to be accepted and liked by peers ([Torrance, 1968](#)). Importantly, [Guignard and Lubart \(2006\)](#) proposed a cognitive explanation with regard to [Piaget's \(1970\)](#) cognitive development theory, claiming that in this period, children develop from concrete operations to formal operations and the emergence of constrained logical reasoning abilities interrupts the development of freely associative creativity. Empirical evidence supports their view. In the study of [Lubart and Lautrey \(1996\)](#), third-, fourth-, and fifth-grade children received divergent thinking (unusual uses) and reasoning (a class-inclusion task) assessments. The results showed a fourth-grade slump in creative performance from third to fifth grades (in a U shape), whereas there was a continuous growth in reasoning performance across age. [Georgsdottir et al. \(2002\)](#) also replicated these results with different creativity (a free-association task) and reasoning (a logical implication task) measures.

Given the fruitful empirical findings and explanations of the fourth-grade slump phenomenon, recent studies have presented different developmental trajectories in creativity performance other than in divergent thinking. Researchers have investigated the development of insight and divergent thinking performances across adolescence, and found an ascending trend for insight performance but no age-group differences for verbal divergent thinking performance ([Kleibeuker et al., 2013](#)). [Alfonso-Benlliure and Santos \(2016\)](#) observed different trends in divergent and evaluative skills from Grade 1 to Grade 6 children; while their divergent skills showed greater variability and irregularity, as [Torrance \(1968\)](#) found, some evaluative indices showed a steadily ascending fashion. [Howe, Garner, Charlesworth, and Knott \(2011\)](#) developed norms for the compound remote associate task (CRAT, inherited from [Mednick and Mednick's \(1967\)](#) remote associate test, RAT) and found increasing task performance from 7- to 11-year-old children. Although the phenomena were evident, explanations for how those creativity measures differed and why different creativities develop distinctly are still rare in previous studies. The present study therefore aims to provide a cognitive explanation and conduct empirical experiments for examination.

### 1.2. *Dual-process account of creativity*

The dual-process account of creativity theory ([Lin & Lien, 2013a](#); [Lin et al., 2012](#)) was recently developed based on the dual-process theories of thinking (e.g., [Evans, 2007](#); [Evans & Stanovich, 2013](#); [Kahneman & Frederick, 2002](#); [Slooman, 1996](#); [Stanovich & West, 2000](#)). [Evans and Stanovich \(2013\)](#) stated that people have two types of information-processing modes: the intuitive, automatic, associative, and experiential Type 1 processing; and the reflective, analytical, logical, and resource-limited Type 2 processing (the distinction is also comparable to [Kris's \(1952\)](#) primary versus secondary thinking modes). When performing a reasoning task such as syllogism, people can adopt Type 1 processing to judge the conclusion according to their prior knowledge (which often yields the so-called “belief-bias phenomenon,” [Evans, 2003](#)), or they could utilise Type 2 processing for analysing and decontextualisation to produce logically correct answers. In the dual-process account of creativity theory, researchers have incorporated this view into the creativity domain and claimed the different involvement of Type 1 and Type 2 processing in open- versus closed-ended creative potentials. An open-ended creativity problem (such as in the divergent thinking test) emphasises fluency, flexibility, and originality, and encourages as many and novel ideas as possible. On the other hand, a closed-ended creativity problem (such as an insight problem) not only requires novelty but also evaluation and appropriateness to fulfil the one final correct answer (see also [Wakefield's classification, 1989](#)). It is therefore hypothesised that open-ended creativity mainly relies on associative Type 1 processing, whereas closed-ended creativity requires both Type 1 and analytical Type 2 processing.

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