



# Creativity in Education

## Research Report

April  
2024

# THE BIC CORPORATE FOUNDATION

For more than 75 years, BIC has offered high-quality pens, pencils and markers to millions of people.

These simply iconic products naturally link education to our business and that's why supporting education is part of BIC's DNA.

Founded in 2016, the BIC Corporate Foundation supports; educational initiatives worldwide because we believe it is a fundamental right and an essential cornerstone of all personal and societal development.

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# Introduction

At the BIC Corporate Foundation, our mission is clear: to foster creativity within education systems worldwide and nurture the creative skills of our youth, with a particular focus on underserved communities. With immense pleasure, we present this Research report, a unique compilation showcasing the groundbreaking work of creative researchers in education.

This document represents a collaborative effort to bridge the gap between researchers and practitioners. The ultimate goal is to embed creativity effectively into education systems, policies, and practices across the globe. I extend my heartfelt gratitude to all the researchers who generously shared their work, confident that their findings will captivate and inspire readers.

I sincerely appreciate Todd Lubart and Michael Hanchett Hanson of the International Society for the Study of Creativity and Innovation (ISSCI) for their visionary leadership and inspiration in creating this report.

The intersection of creativity and education is a topic close to my heart. I have witnessed firsthand the transformative power of creative teaching practices on students. Throughout my career, I have seen how innovative approaches to education can ignite a passion for learning and empower students to reach their full potential. Because of this, I am passionate about our work at the BIC Corporate Foundation.

Our partnership with ISSCI and the release of this State of Research report represent a significant step forward in our collective efforts to advance creativity in education. As you delve into this report's findings, I invite you to reflect on your own experiences with creativity, your education or that of your children, and your own work practices.

Together, we can meaningfully impact the future of education and harness the transformative potential of creative thinking in our workplace and for future generations.



**Alison James**

Executive Director  
BIC Corporate Foundation

# Introduction



The education of creativity, as a 21st century skills, and education of all topics delivered in a creative way, are two of the contact points between creativity and education that have received attention in recent research. The C-COP initiative of the BIC Foundation teamed up with ISSCI - the International Society for the Study of Creativity and Innovation to showcase some of the work that is currently in progress at the creativity-education intersection.

ISSCI is a non-profit scientific organization with approximately 300 creativity and innovation researchers as members. Whereas a growing body of academic research on creativity in general, and creativity and education in particular has been accumulating since more than a century, the findings are not always known to the educational community at large.

This state of research report offers a glimpse into some current work that may be relevant to educators. There is no claim to be exhaustive. Researchers from the ISSCI network who volunteered to share their work and some practical

implications open the door to future connections that may contribute to the development of creativity and its integration in educational contexts.

At the same time, an important message from this document is the breadth of serious research happening in the education field around the issues that creativity raises - approaches that, together, address the complexity of both education and the development of creative perspectives among students and educators. In the range of topics, methods, and contexts studied, this sample of current research shows the worldwide efforts to understand and to responsibly and positively integrate creativity into educational practice, efforts that the C-COP initiative have encouraged and helped publicize.

This document is also an invitation to connect, and ultimately to foster creativity through education. Creativity, a 21st century skill that is increasingly recognized as a component of personal well being, life success, professional.

## Todd Lubart

Professor of Psychology  
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ISSCI President



## Michael Hanchett Hanson

Director, Masters Concentration in  
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Teachers College, Columbia University  
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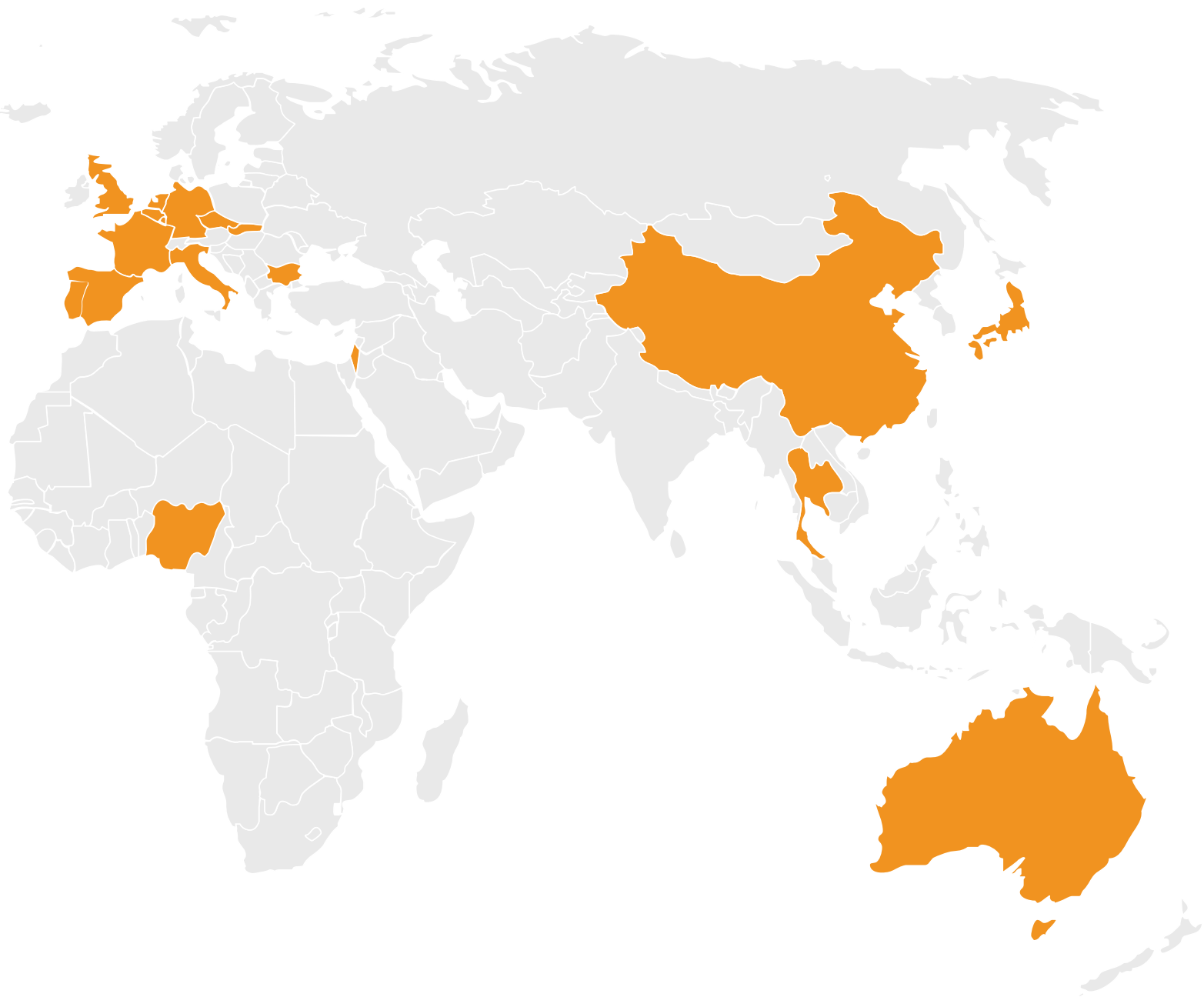


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**72 Contributions**  
**44 Researchers**



**22 Countries**

# Selcuk ACAR

## Measuring Original Thinking in Elementary School: Development and Validation of a Computational Psychometric Approach

Creativity is highly valued in both education and the workforce, but assessing and developing creativity can be difficult without psychometrically robust and affordable tools. The open-ended nature of creativity assessments has made them difficult to score, expensive, often imprecise, and therefore impractical for school- or district-wide use. To address this challenge, we developed and validated the Measure of Original Thinking for Elementary School (MOTES) in five phases, including the development of the item pool and test instructions, expert validation, cognitive pilots, and validation of the automated scoring and latent test structure. MOTES consists of three game-like computerized activities (uses, examples, and sentence subscales), with eight items in each for a total of 24 items. Using large language modeling techniques, MOTES is scored for originality by our open-access artificial intelligence platform with a high level of agreement with independent subjective human ratings across all three subscales at the response level ( $r_s = .79, .91, \text{ and } .85$  for uses, examples, and sentences, respectively). Confirmatory factor analyses showed a good fit with three factors corresponding to each game, subsumed under a higher-order originality factor. Internal consistency reliability was strong for both the subscales ( $H = 0.82, 0.85, \text{ and } 0.88$  for uses, examples, and sentences, respectively) and the higher-order originality factor ( $H = 0.89$ ). MOTES scores showed moderate positive correlations with external creative performance indicators as well as academic achievement. The implications of these findings are discussed concerning the challenges of assessing creativity in schools and research.



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### **The outcome of the research:**

The automated scoring methods employed by MOTES overcome cost-ineffectiveness and lack of affordability issues associated with traditional creativity tests, offering a reliable and affordable means of measuring original thinking in the verbal domain. These scores can be utilized alongside other indicators of school learning and academic achievement, highlighting the potential for creativity assessment to play a pivotal role in school-based programming and development efforts including some high-stakes uses such as advanced academics and gifted identification.



# Sergio AGNOLI

## **The Dynamic Interplay of Affective, Cognitive and Contextual Resources on Children's Creative Potential: The Modulatory Role of Trait Emotional Intelligence**

In this work we explored in two separate studies the modulatory role of trait emotional intelligence (EI) over the effect exerted on children's creative potential by two other key elements defining creativity, namely cognitive resources (here explored through basic executive functions, Study 1) and contextual-environmental factors (that is, teachers' implicit conceptions of the factors influencing children's creativity, Study 2). Confirming previous research, executive functions (particularly interference control and working memory) emerged as main predictors of children's creative performance; however, their positive effect arose especially when associated with a high trait EI level. In the same vein, teachers' implicit conception about children's creative potential and about their efficacy in teaching creativity emerged to exert a facilitatory effect on children's creative potential. This effect occurred particularly when associated with low trait EI levels, affecting differently girls and boys. Trait EI emerged from these studies as an important individual resource to consider in order to understand the potential benefit of other (cognitive and contextual-environmental) resources on children's creative potential.



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### **The outcome of the research:**

The results of this work suggest that when developing programs or training interventions for the management and increase of creative potential, it would be particularly important to take into account both cognitive and emotional resources in the students as well as the teachers' perception of the resources that can be used to teach creativity. Therefore, we suggest that, starting from successful trainings of creative potential (see Scott et al. 2004a, 2004b) and trait emotional intelligence (see Nelis et al. 2009), integrated interventions targeting children's cognitive and emotional aspects of creative potential and teachers' perception of creativity should be developed, thus involving both students and teachers.

## **Creative Thinking Training for Children (CTT-C): How emotional intelligence interacts with a training intervention in enhancing children's creative potential**

Creative potential is a set of multidimensional resources concerning the latent ability to produce original and adaptive work. Confluent theoretical models, in particular, stated that, in order to express creative potential in an effective way, resources should converge and interact efficiently. Within such a confluent framework, the present study explored whether the increase in specific cognitive resources defining creative potential during childhood, as induced through a newly developed training intervention (Creative Thinking Training for Children - CTT-C) based on the creation of fairy tales, could be affected by another constitutional dimension, that is, children's emotional resources and, in particular, their trait emotional intelligence (EI). A total of 410 children from 3rd to 5th grade of primary school were involved in the study, equally divided in a training group and in a control group. Results showed that the fairy tale-based training protocol was effective in increasing children's creative potential. More importantly, results showed that the training intervention was particularly effective in increasing the ability to generate original contents in children with low-to-medium trait EI levels. These findings showed that emotional intelligence is a central factor to be considered when exploring the efficacy of a training intervention aimed at increasing children's creative potential.

### **The outcome of the research:**

Confirming results of past research (Scott et al., 2004a, 2004b; Tsai, 2013), the findings of this study demonstrated that children's creative potential can be increased through a dedicated training intervention specifically developed following the indications of scientific literature. In particular, the findings showed an increase in creative potential through the training of specific cognitive abilities related to creative thinking. CTT-C exerted, for instance, children's ability to think flexibly, switching between different perspectives while generating new contents, as well as their ability to generate multiple alternative ideas, that is, children's generative fluency. Moreover, CTT-C was centered on the training of both idea generation and idea evaluation, exerting also children's ability to assess original and effective ideas. In addition, the training of cognitive abilities was accompanied by specific exercises devoted to the meta-cognitive understanding of the meanings of the processes underpinning creative thinking to allow the achievement of an awareness of their use. More importantly for the purpose of the present study, we demonstrated that children's emotional intelligence has an effect on the efficacy of the training intervention. Specifically, the interactive effect of emotional intelligence on training efficacy emerged in the integrative ability to generate original contents. All in all, we can assume that children's tendencies in the management of emotions are fundamental variables that should be considered when creative potential is taken into account or when specific trainings for the increase of creative potential are developed

## **The role of motivation in the prediction of creative achievement inside and outside of the school environment.**

This study used a latent variable modeling approach to investigate the influence of motivation on creative achievement in different environments. This was used in conjunction and interaction with other creativity-related predictors, such as openness to new experiences and response originality in a divergent thinking task. Specifically, the inside school and the outside school environments were analyzed in a sample of university students. Results showed that the interaction between openness and intrinsic motivation was the strongest predictor of creative achievement. This interaction predicted both outside and inside school creative achievement, which was further influenced by extrinsic tendencies. In particular, intrinsic motivation predicted creative achievement only when associated with a medium or high level of openness to experience. Originality only predicted outside school creative achievement.

### **The outcome of the research:**

The results emerged from this study provide useful insights into the educational practice directed towards the fostering of creativity within the schools. The first aspect regards the nurturing of teachers' ethos (Lin, 2011), which includes conserving an open attitude towards creative behavior and especially valuing independence of thinking. In addition, our results indicate that educational approaches should not only use imaginative approaches to make learning more interesting, attracting therefore students' intrinsic motivation tendencies, but also promoting their open-mindedness. This second aspect emerged to be essential, enabling intrinsic motivation (i.e., students' interest) to be effective in creative success within school. Fostering open-mindedness emerged to be, therefore, a prerequisite in order to allow intrinsic motivation to expand to a wide array of activities. Finally, given that creative success within the inside-school environment is predicted by both intrinsic and extrinsic motivational attitudes, we can infer that the cumulative action of these motivational drives could potentially produce high creative achievements. The school environment emerged from these results as a context with a high potential to express outstanding creative acts. The most important issue from an educational point of view is finding the right approach to foster and realize the hidden potential which is still not expressed.

# Paula ALVAREZ HUERTA

## Student engagement and creative confidence beliefs in higher education

The fostering of creativity in higher education has been linked to enhanced professional competencies and personal development among students. The main aim of this study was to examine the relationship between student engagement and creative self-concept in undergraduates. The sample comprised 775 students (51.61 % female, 46.32 % male, 2.07 % other) from two Spanish universities, ranging in age from 17 to 43 years ( $M = 20.78$ ,  $SD = 2.65$ ). Students from the first and final year of various degree programs completed the National Survey of Student Engagement and a measure of creative self-concept. Results showed a positive relationship between student engagement and creative self-concept, as well as differences by gender, field of study, and academic year concerning the dimensions of engagement that contributed most to enhanced creative confidence beliefs. The study highlights the importance of ensuring that students in higher education have the opportunity to participate in collaborative learning, meaningful interactions with faculty, higher-order learning, reflective and integrative learning, and high-impact practices. Higher-order learning and reflective and integrative learning appear to be particularly important in the early stages of a degree program, whereas, with senior students, greater emphasis should be placed on reflective and integrative learning and high-impact practices.



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### The outcome of the research:

The results of this study show that creative self-concept is positively associated with student engagement in higher education. This highlights the importance of ensuring that students have the opportunity to participate in collaborative learning, meaningful interactions with faculty, higher-order learning, reflective and integrative learning, and high-impact practices. Higher-order learning and reflective and integrative learning appear to be particularly important in the early stages of a degree program, whereas, with senior students, greater emphasis should be placed on reflective and integrative learning and high-impact practices.

# ROSS ANDERSON

## **Reinvigorating the desire to teach: Teacher professional development for creativity, agency, stress reduc- tion, and well-being**

This mixed methods study analyzes the effectiveness of a hybrid professional development model focused on teachers' creative agency during the COVID-19 pandemic period of intensified stress, anxiety, and disconnect. The professional development program, called makeSPACE, provides teachers with research-based frameworks for creative teaching and learning, starting with creative and artistic routines they experience for themselves and then integrate into classroom teaching and learning. Teachers' creative development enables them to model, message, and set conditions for students' creative risk-taking, in turn. Fifty-three K-12 teachers participated from the Pacific Northwest of the United States. Results indicated the PD experience contributed to substantial increases in teachers' creative agency, empathy for students' risk-taking, joy and resilience in teaching, and a sense of support for creativity in their school. Additionally, results indicated a substantial reduction in the secondary traumatic stress they experienced due to their students struggling through the trauma of the COVID-19 pandemic and school shutdowns. Teachers' creative development coincided with improved stress management and resilience. Qualitative analyses illustrated a variety of personalized pathways for how teachers' creative development and integration of creativity in teaching and learning facilitated those improvements in their well-being. The evidence suggests teachers' creative agency and wellbeing can develop through a complementary process, rooted in carefully scaffolded creative and artistic development.



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### **The outcome of the research:**

Teacher professional development program and a scale-up federal grant.

## **Reflection in the creative process of early adolescents: The mediating roles of creative metacognition, self-efficacy, and self-concept.**

This study focused on the role of creative agency in early adolescence (age 11-13), especially related to students' creative metacognition and creative self-beliefs. Generally, the self-perceptive and self-reflective dimension of creative production have received less attention than the cognitive factors that contribute to the development of an individual's creative process and production. A growing evidence base suggests that creative self-beliefs play a pivotal role in different aspects of the creative process. Moreover, metacognition about the creative process may bridge the self-perceptive to the cognitive through aspects of self-awareness, strategy selection, self-evaluation, and contextual knowledge. In the two studies reported in this paper, we described the nature of creative self-beliefs and metacognition in early adolescence and tested their relationships in the model of creative behavior as agentic action. Results indicated strong evidence of reliability and validity of the scores for the creative task that asked students to invent, draw, and describe an imaginary creature. Six raters used the consensual assessment technique to rate the creativity of each students' response. Results showed that different factors of creative potential predicted creative self-beliefs, creative metacognition, and creative production in the task; however, all effects on creative production were mediated by creative metacognition and self-beliefs, showing the importance of these factors to how and why students produced creative work. Results supported the model of creative behavior as agentic action, underscoring the important role of metacognition and both personal and socially mediated modes of agency. Moreover, arts integration experience in the ArtCore model contributed to the cultivation of creative production, metacognition, and self-beliefs. Middle school students' creative strategy selection and self-regulation were the most salient of creative metacognitive components. The results of this study encourage a focus on educational practices and conditions, such as routine creative learning and teacher modeling, that support students' metacognitive development in their creative selves.

### **The outcome of the research:**

Arts integrated instructional and curricular exemplars and professional development

# Honghong BAI

## The Benefits of the Learn to Think Program for Preschoolers' Creativity: An Explorative Study

This paper presents the Learn to Think preschool (LTT-P) program for promoting creativity in preschoolers and reviews its potential benefits. LTT-P was designed within the framework of the successful LTT creativity program for older students and both were developed to fit the Chinese education system. To assess the potential benefits of LTT-P, a quasi-experimental pretest-posttest control group study was conducted in a preschool in an urban region in the northwest of China, involving 68 middle-level and 87 senior-level children. The Lines and Circles subtests of the Torrance Test of Creative Thinking were used to examine the development of children's creativity on the dimensions of fluency, originality, and elaboration between the pretest and posttest. The results suggest that the LTT-P program has the potential to promote young children's creative thinking, especially with regard to the aspects of originality and elaboration. The results for fluency are less clear. To the best of our knowledge, LTT-P is the first program, grounded in a structured learning theory and sound curriculum framework, to support children's creativity development in Chinese early childhood education.



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### The outcome of the research:

Training program for teachers / published books

## **Serial Order Effect in Divergent Thinking in Five- to Six-Year-Olds: Individual Differences as Related to Executive Functions**

This study examined the unfolding in real time of original ideas during divergent thinking (DT) in five- to six-year-olds and related individual differences in DT to executive functions (EFs). The Alternative Uses Task was administered with verbal prompts that encouraged children to report on their thinking processes while generating uses for daily objects. In addition to coding the originality of each use, the domain-specific DT processes of memory retrieval and mental operations were coded from children's explanations. Six EF tasks were administered and combined into composites to measure working memory, shifting, inhibition, and selective attention. The results replicated findings of a previous study with the same children but at age of four years: (1) there was a serial order effect of the originality of uses; and (2) the process of mental operations predicted the originality of uses. Next, the results revealed that both domain-general EFs and domain-specific executive processes played a role in the real-time unfolding of original ideas during DT. Particularly, the DT process of mental operations was positively related to the early generation of original ideas, while selective attention was negatively related to the later generation of original ideas. These findings deepen our understanding of how controlled executive processes operate during DT.

### **The outcome of the research:**

Research article / with the potential to be applied in designing personalized instructions for fostering children's creativity



# Baptiste BARBOT

# Jean URBANIAK

## **The Influence of School Evaluation Context on Adolescent Creative Performance: Implications for Educational Practices.**

The objective of this study was to examine how the school evaluation context influences adolescents' creative performance in a range of tasks (varying in terms of modalities, thinking processes involved, and instructions) while considering a set of variables known to impact creative performance, including age and gender. 428 Belgian students (mean age = 14.31; sd age = 1.58; 51% female), from 1st to 5th year of secondary school (i.e., 7th to 11th grade in the US system) took part in this study. Participants completed, in classroom settings, four creative tasks targeting associative thinking and ideation across visual/graphic and verbal/written modalities, as well as a state-stress measure. Evaluation expectation (explicit evaluation context) was manipulated by instructing half of the participants' sample that the results of their tests would be communicated to their teachers and considered during class councils (expected evaluation modality). The other half were instructed that tasks were to be completed for training/entertainment purposes (i.e., training modality, acting as control). Results showed a principal effect of the explicit evaluation context on the fluency score for the graphic ideation task. An interaction effect between school grade and the explicit evaluation context has also been found on this score and on the originality score for the verbal ideation task, with a more and more detrimental effect across grades. Finally, stress interacts with explicit evaluation context on fluency score for this last task: in the training modality, the most stressed students generated significantly fewer associations than the least stressed ones. In the expected evaluation modality, there was no sizeable difference in performance according to the level of state stress.



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### **The outcome of the research:**

Results showed that the explicit evaluation context in school had an overall detrimental effect on several aspects of creativity, with a differential effect according to the task considered. These findings highlight the importance of the school evaluation context when assessing creativity, which has critical implications for supporting an accurate monitoring of creativity change and development in school settings.

# Asdrúbal BORGES FORMIGA SOBRINHO

**The importance of material aspects in stimulating creativity in teaching processes.**

The democratization of access to information, coupled with social interactions also enhanced by online communication channels, enhances the construction of knowledge. This potential involves interaction among the materiality of devices, teaching platforms, and users' bodies, along with their physical, psychological, and physiological functioning. Throughout educational processes, the mediation of different mediums can facilitate collaboration between teacher and student, as well as among students. Thus, communication constitutes an important aspect of learning and creativity, as it can enhance action and collaboration towards the new. Therefore, it is pertinent to investigate how it is managed by the teacher in educational environments, through the use of data collection methods such as non-participant observation and semi-structured interviews; and data processing methods such as thematic analysis.



 **Brasil**

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## **The outcome of the research:**

Sharing knowledge with teachers and researchers regarding creative teaching in the domain of Mathematics and seeking to reduce student dropout rates in courses whose curricula are integrated by the subject of Calculus 1.

## **Creativity in response to the impacts of the COVID-19 pandemic on teaching and learning strategies adopted in basic-level schools.**

The suspension of classes has brought schools the challenge of quickly adapting to emergency remote teaching, requiring more solutions with the use of creativity to connect individual purposes with those of the school and those shared with an entire society facing the COVID-19 pandemic. Creativity can be understood based on actions, interactions, and meanings capable of generating changes in culture and/or individuals. Since present actions can be guided by purposes shaped over time and capable of producing future-oriented actions, they can be considered creative according to prevailing values in a culture and when they connect individuals with social purposes. However, the current context demands quick solutions to present problems, aiming to ensure a future for activities such as teaching and learning. This questions the concept of creativity and the very process of development of the individuals within the school, contributing to the importance of: investigating the perception of children and teachers about their own creativity; and demonstrating how the connection between individual and collective purposes influences the search for solutions to problems in an adverse social and cultural context.

### **The outcome of the research:**

Knowledge shared with teachers and researchers regarding creative teaching for children, and potential preparation to continue teaching activities in adverse conditions and more intensely mediated by technological devices.

# Anaëlle CAMARDA

## Opposite Effect of Social Evaluation on Creative Idea Generation in Early and Middle Adolescents

The purpose of this study was to examine how social evaluation influences creative idea generation and whether this effect develops with age. To do so, early adolescents, middle adolescents, and late adolescents were asked to complete a creative task, either alone or under the supervision of an adult examiner who evaluated the participant. The responses generated by the participants were analyzed via measures of fluency (i.e., number of ideas generated), fixation (i.e., number of ideas generated in the fixation effects of the individual, considered as usual and non-creative), and expansion (i.e., number of ideas generated outside the effects of the individual's fixations, considered as creative).

Three major findings emerge: 1) social evaluation by an adult expert is detrimental to creativity in children but 2) beneficial in adolescence, while 3) it has no effect on late adolescents. These results were observed on the measure of fluidity and expansivity, but not on the measure of fixation. In other words, the effect of the social context of evaluation is only observed when an individual generates creative (expansive) ideas. This study is the first to provide evidence that adult social evaluation has an opposing effect on creative idea generation in children and adolescents, and suggests new directions for studying social influences on creativity from a developmental perspective.

Three major findings emerge: 1) social evaluation by an adult expert is detrimental to creativity in children but 2) beneficial in adolescence, while 3) it has no effect on late adolescents. These results were observed on the measure of fluidity and expansivity, but not on the measure of fixation. In other words, the effect of the social context of evaluation is only observed when an individual generates creative (expansive) ideas. This study is the first to provide evidence that adult social evaluation has an opposing effect on creative idea generation in children and adolescents, and suggests new directions for studying social influences on creativity from a developmental perspective.



 **France**

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### The outcome of the research:

The results of this study provide additional elements to two specific pieces of literature, which do not dialogue with each other: The first is the social literature of creativity, which has been strongly supported by the work of Teresa Amabile, and which hypothesizes that the effect of a social context is only induced by its nature, and not individuals' age. The second is the literature on risk-taking in adolescence (e.g., Blakemore & Robbins, 2012; Crone & Dahl, 2012; Steinberg, 2008; 2014), which demonstrates that the same social context can induce distinct behaviors in adolescents and adults. Thus, our results demonstrated for the first time that the same social context (i.e., evaluation context) can have a different influence depending on the age of the individual performing a creative problem-solving task, while it was supposed to induce a reduction in creativity regardless participants' age according to Amabile (2012). The results are discussed considering the development of maturity of a key cognitive process for resisting social context, the emotional regulation skills. It then seems fundamental to take into consideration the nature of the social context in which children and adolescents evolve to better understand the impact of creativity learning procedures - especially in classroom. Thus, creative problem-solving skills are certainly impacted by the school environment as well as the induction of assessment expectations by the teacher.

## **Teaching creativity at school: The impact of a five-week training in brainstorming, “in the manner of” and a C-K driven method on children’s creative ideation and writing**

Although developing individuals’ ability to solve problems creatively is a societal challenge, teachers have difficulty stimulating this skill at school: few methods are available to them, and their effectiveness has been little studied. Thus, the present study aims to investigate whether usual methods used in the classroom are effective in stimulating children’s creativity and how we can propose methods that combine teachers’ needs with cognitive modeling. For 5 weeks, 115 children ( $m = 10.3$  y-old) participated in workshops in which one of the following creativity methods was used: the method “in the manner of” consisting of presenting an example in or outside the fixation bias of children, the brainstorming method and the C-K driven method. A pre-test and post-test battery was used to measure near and far transfer effects. The main results show that brainstorming is deleterious for children’s generation of creative ideas from its first use but that it has no effect beyond the workshop sessions. The use of examples, creative or classic, only increases the number of uncreative ideas generated by children, and its effect persists after workshop sessions. Finally, the method based on C-K has a positive effect on children’s creative ideas generation after its second use and is internalized a posteriori. For the first time, the effectiveness and limits of these creativity methods have been studied in an educational setting, using an action research paradigm. The results are discussed in the light of children’s creativity development models and highlight the importance of increasing interaction between researchers and teaching specialists to improve creative tools used in the classroom.

### **The outcome of the research:**

This study shows for the first time what are the effects of different methods often used by teachers in their classroom, naming brainstorming, “in the manner of” and a method inspired by CK and based on cognitive models of creativity. Beyond the interest of observing the impact of each method at the precise moment of its use and after repetition of its use, the results suggest that future studies should be carried out jointly between teachers and researchers in applied research programs so that the methods proposed in the future to teachers are both adapted to their needs and based on the scientific research knowledge.

Also, this work was proposed as an extension of the first work mentioned above, since this experimental situation made it possible to compare the use of individual and collective methods in the classroom. What the results demonstrate is that, for pre-adolescents, the social context can have a beneficial impact in the classroom compared to an individual work context, only when it is accompanied by a meta cognitive method of creativity.

# Macarena-Paz CELUME

## **Mood and creativity in children: Differential impacts on convergent and divergent thinking.**

This article talks about the interaction between positive emotions and creativity in educational settings. Mood has been consistently related to creative thinking, but the effects of mood induction on divergent thinking have been largely studied only in adults. This study compared the effects of positive versus neutral mood inductions on both convergent and divergent (graphic) creative thinking among elementary school children. We hypothesized that after the mood induction, children in the positive mood condition compared to their peers in the neutral condition would (a) perform better in a divergent thinking task for all performance criteria (fluency, flexibility, and originality); (b) perform better in the creative convergent thinking task; and (c) produce more positive elements in their drawings. The results showed that the positive mood condition group had higher divergent thinking scores for originality, the creative convergent thinking task scores were higher for children in the positive mood condition, and there were no differences in the valence in the children's drawings across all mood induction conditions. Results imply a need of a negative mood induction and the measurement of arousal in order to have more conclusive results on how different moods interact with creative thinking in children. Nevertheless, these findings provide a better understanding of the impact of different emotional states on children's creative thinking and thus it can help educators and policymakers create methodologies to more effectively engage students in developing creative thinking in the classroom.



 **France**

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### **The outcome of the research:**

Positive mood (emotional state) seems to foster originality and convergent creative thinking.

# Sudapa CHOMPUNUCH

## Team Creativity: A deep dive into developing a taxonomy.

This in-progress paper used a systematic literature review approach. This paper presents 274 team creativity criteria that were collected from 193 references and were classified using the Input-Mediator-Output (IMO) team effectiveness framework (Mathieu, 2008).



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### The outcome of the research:

A taxonomy "Team Creativity IMOT model (TCIM)" (Input-Mediator-Output-Time) helps to better understand the current known criteria contributing to team creativity. Additionally, the proposed classification taxonomy reveals some interesting findings, including the specific criteria used for Individual, Group, and Team, the commonly used criteria only for team level, and their correlation, etc. This study helps provide a clearer picture of what leads to team creativity and its underlying dimensions.

## **Unpacking Team Creativity: An In-Depth Analysis Using the Critical Incidents Approach**

This in-progress paper will present the application of the Critical incident technique (CIT) to understand the team creativity process within a specific context. Our research revealed that it is essential to delve into the specific nuances of the context surrounding team creativity. To gain a deeper understanding of these complexes, we modified CIT for our study. We conducted in-depth interviews using the Critical Incidents Technique to collect insights from 33 team leaders about their experiences in both successful and unsuccessful creative projects. The goal was to identify critical moments in the team's creativity process. We assume that team creativity is context-dependent and specific situations.

### **The outcome of the research:**

A significant theoretical advancement involves understanding how the surrounding environment affects a team's creativity. By focusing on detailed context-specific investigations using the Critical Incident Technique (CIT), we question the idea that a single method can apply universally. We examine and delve into 21 key events in team creativity, which provides valuable insights into how team creativity is influenced by its ever-changing and context-specific nature.



# Edward P. CLAPP and Col- leagues

## **Creative Wellbeing: Healing and Thriving through Making and Doing**

As a species, we have been makers of things and creators of experiences, but in our current fast-paced and technology-driven world, we don't always take the time to engage in hands-on creative work. Making and creating is elevated when it is brought to the collective or community level—when we engage in creative work with others—and yet again, too often, many of us lack the opportunity to participate in broader creative experiences. Lacking the opportunity to engage in this important part of our humanity may have adverse effects on our overall sense of well-being. This is especially true for young people who, too often are driven to learn in environments that adhere to industrial-era models of education with little opportunity to engage in creativity and hands-on learning.

The newly established Center for Creative Wellbeing is composed of scholars and practitioners from the fields of education, entrepreneurship, mindfulness, and psychology—each interested in exploring the relationship between creativity and wellness. Here, creative well-being is loosely defined as the pursuit of healing and thriving through making and doing. The exploratory work of the Center for Creative Wellbeing is currently being pursued through a literature review, interviews, theory building, and test retreats.



## **United States**

### **The outcome of the research:**

The intended outcomes for this exploratory inquiry are to establish a series of tools and strategies that support creative well-being in schools, the workplace, the home, and throughout communities.

# Giovanni Emanuele CORAZZA

## Intelligence and Creativity: Mapping Constructs on the Space-Time Continuum.

This theoretical article, co-authored with Prof. Todd Lubart of Université Paris Cité, proposes a unified framework of analysis for the constructs of intelligence and creativity. General definitions for intelligence and creativity are provided, allowing fair comparisons between the two context-embedded constructs. A novel taxonomy is introduced to classify the contexts in which intelligent and/or creative behavior can be embedded in terms of the tightness vs. looseness of the relevant conceptual space  $S$  and available time  $T$ . These two dimensions are used to form what is identified as the space-time continuum (STC), containing four quadrants: tight space and tight time, loose space and tight time, tight space and loose time, loose space and loose time. The intelligence and creativity constructs can be mapped onto the four quadrants and found to overlap more or less, depending on the context characteristics. Measurement methodologies adapted to the four different quadrants are discussed. The article concludes with a discussion about future research directions based on the proposed theoretical framework in terms of theories and hypotheses on the intelligence and creativity of eminent personalities and personality traits, as well as its consequences for developmental, educational, and professional environments.



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### The outcome of the research:

From the educational point of view, the STC can be usefully exploited in the design of the context for pedagogical trajectories that are controlled in terms of the tightness-looseness of the involved conceptual space  $S$  and available time  $T$ . This approach can therefore be hypothesized to bear critical consequences on the development of both intelligence and creativity of pupils, as it provides a balanced ground for the expression of both constructs. Furthermore, the consonance or contrast between the context one experiences in the family and at school will largely determine success in educational endeavors.

# David CROPLEY

## Supporting Creative Teaching and Learning in the Classroom: Myths, Models, and Measures

Creativity is enjoying a resurgence of interest in the education systems of many developed countries. The core of this is the recognition that creativity, in its broadest sense, encompasses divergent thinking, problem-solving, and related abilities, and is a core skill in the 21st century. While there is a great deal of rigorous, empirical research that underpins creative teaching and learning, there remains much rhetoric, myth, and misconception that militates against efforts to embed creativity in the modern classroom. In this chapter, we first explore some of the general beliefs that frequently interfere with efforts to broaden and systematize the understanding of creativity. We also examine specific evidence from teachers, suggesting that this practitioner cohort is favorably primed and disposed to teach both for and with creativity. In the literature on creative education, we identify and address a significant gap relating to developmental models of creativity. Finally, we discuss some of the nuances of creativity in school settings, offering specific advice for school teachers who are at the coal-face of creative education.



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### The outcome of the research:

Concrete advice for teachers who are trying to embed creativity in the classroom.

## **Explaining Standardized Educational Test Scores: The Role of Creativity Above and Beyond GPA and Personality**

Most standardized educational tests are not intended to assess creativity. Past research in this domain has been largely correlational, examining the associations between creative beliefs or performance and scores on such tests. Hence, the primary aim of the current investigation was to determine whether different metrics of creativity predict performance on standardized academic tests. Specifically, measures of creative performance, potential, self-reports, and beliefs were collected along with personality indicators and academic data (grade point averages, Australian Tertiary Admission Ranking [ATAR] scores) for Australian student participants. Results from a hierarchical multiple regression indicated that various creative potential, ability, and trait measures accounted for 18% of unique variance in ATAR scores over and above the contribution of GPA, higher conscientiousness, and higher introversion. Specifically, significant creativity predictors were self-rated scholarly creativity and intellectual risk-taking, scored flexibility on a divergent thinking task, and rated originality in generating a math equation. The findings suggest the importance of both convergent and divergent thinking abilities in positively influencing traditional academic outcomes. Limitations and suggestions for future research are discussed.

### **The outcome of the research:**

Several measures of creativity predict student performance in standardized test scores.

## **The Creative Student in the Eyes of a Teacher: A Cross-Cultural Study**

How do teachers perceive creative students, and what are the commonalities and specificities of such perception among teachers from different countries? To explore this question, we asked teachers from Australia, Italy, Poland, and the United Kingdom (total N=933) to answer a set of items describing different traits of their students. Network and factor analyses revealed that teachers' perception of creative students synthesized into three broad groups: (1) Cognitive traits typically associated with creativity; (2) Nonconformist and impulsive behaviors; and (3) Adaptiveness. While the first two factors were found to be largely equivalent across countries, perceiving creative students in terms of adaptive behaviors varied significantly between countries. Cognitive characteristics were the most dominant in creative students' perception, followed by Adaptiveness and Nonconformism. Findings are discussed in light of potential opportunities and limitations to support creativity in school settings.

### **The outcome of the research:**

A deeper understanding of how teachers perceive creative students.

## **The development of mathematical creativity across high school: Increasing, decreasing, or both?**

The advent of the Fourth Industrial Revolution (Industry 4.0) and a broader digital transformation of society is driving both a renewed focus on Science, Technology, Engineering, and Mathematics (STEM) education as well as a recognition that creativity is a prerequisite for employment in the 21st century. Together, these elements are the catalyst for a key question: what is the impact of school education, in its broadest sense, on the development of STEM-based creativity in children? To shed greater light on this question, this study focuses on mathematical creativity in children across grades six-12 at a large Australian school. The study reported in this paper found that although mathematical creativity increases from year to year, there is a significant within-year decline in creativity. This paper explores possible explanations for this decline, suggesting that it is driven by a combination of environmental, personal, and process-related factors present in the context of school education. The study sheds light on the relationship between the development of mathematical creativity in high school students and the factors that may impede this development.

### **The outcome of the research:**

Mathematical creativity increased year-on-year but decreased within given years.

# Carolina CUESTA- HINCAPIE

## Are we teaching novice instructional designers to be creative? A qualitative case study.

Creativity is a valuable skill for instructional designers. However, few studies have researched creativity in instructional design (ID) graduate courses. Future professionals' creative thinking is necessary to address societal, technological, and economic challenges. Developing creative thinking in novice instructional designers could allow them to generate creative solutions to ill-structured problems in real-world contexts. This multiple case study investigated the extent to which the nine core courses in an online instructional design master's program encouraged creativity. We conducted a document analysis of course materials for each course to analyze whether creativity indicators derived from creativity literature were present. Subsequently, a cross-case synthesis was used to identify patterns across the cases. Semi-structured interviews of the lead course instructors were conducted to evaluate the extent to which they deliberately included creativity concepts in the course design process. Results indicated core courses include learning activities and instructional strategies with the potential to foster creativity. However, explicit references mentioning creativity or being creative were only found in three courses. Lead instructors considered creativity an important aspect of teaching and learning and a concept that needs to be further developed and discussed in ID education. Implications for instructional design education are discussed.



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### The outcome of the research:

The development of an instrument that could help educators incorporate activities with the potential to foster creativity and creative thinking into ID course design.

We identified the challenges of including creativity in instructional design core courses.

We provide examples of transforming learning objectives and/or discussion prompts to purposely address creativity.

# John DIDIER

## Designer's notebook and creative process

Our research will make it possible to model, to better understand, and to identify the creative process in pupils and student teachers as they design and produce utilitarian objects in educational and training context with ecological validity (real context of training). In the context of teaching creative and manual activities in education in the French part of Switzerland, we are focusing on development of pedagogical methods based on creative processes in line with applied psychology, didactic and pedagogy. This interdisciplinary approach based on pragmatic teaching, develops transversal skills centred on creative-problem solving. According to Sternberg & Grigorenko's categorization of triarchic intelligence (analytical, creative and practical) (Sternberg & Grigorenko, 2004), we argue that the design and realization process of technical objects should promote cognitive factors (divergent & convergent thinking, analogical thinking, analysis, synthesis, flexibility, hypothesis creation and evaluation), conative factors (increase motivation), emotional factors (coping with frustration, with doubts and managing stress) and environmental factors (materials, trainer's instructions, teamwork, external constraints in relationships with their use and utility in a context of production) which influences on the creative potential (Lubart, Mouchiroud, Tordjman, & Zenasni, 2015).



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### **The outcome of the research:**

This research will lead to formulating new input for research on psychology, education science and didactics. The final target of this research will lead to a pedagogical method which will allow developing these aptitudes in students from diverse social backgrounds.



## **Codesign and creative collaboration in teacher training**

We performed a study on future elementary school teachers to determine whether design project-oriented methods combined with short-term training have an effect on their creative processes during co-design. We explored the effects of two types of co-design project-oriented methods corresponding to two types of training: one based on the search for ideas and the other on the constraints linked to the design project. Our hypothesis postulates that training centred on the collective evocation of ideas can encourage divergent thinking and, thus, the evocation of a greater number of ideas. On the other hand, training focused on the management of constraints applied to the design project may encourage the generation of a greater number of constraints, by framing the design problem before or during the generation of ideas, and thus also encourage convergent thinking. From the perspective of cognitive psychology, design activities, which require a certain amount of creativity, are characterized as complex problem-solving activities (Bonnardel, 2006/2012). Implementing creative design activities in educational contexts leads learners to engage in problem-solving that lacks pre-established procedures (Didier & Bonnardel, 2020). In this study, we support the idea that the introduction of creative design activities in training encourages learners - consisting either of pupils, students, or teaching professionals brought into action in the school - to learn how to search for creative ideas, i.e. being both new and adapted to the design problem at hand.

So, to foster creativity in teacher training, we need to propose teaching-learning situations that help develop relevant creative ideas and products. In this creativity training situation, risk-taking should be encouraged, imagination should be fostered from a variety of perspectives, and hypotheses should be formulated within the framework of questioning (Didier & Bonnardel, 2023). In line with these approaches to training school actors in creativity, we have implemented a pedagogical approach based on the Analogy and Constraint Management - A-GC approach (Bonnardel & Didier, 2016, 2020).

### **The outcome of the research:**

This pedagogical approach invites learners to mobilize divergent thinking through idea search combined with the generation of constraints related to the problem at hand to guide the search for ideas, as well as convergent thinking through constraint management to evaluate and select relevant ideas. This approach is directly inspired by design education.

# Denis DUMAS

## How does Creativity Change as Expertise Develops?

Creative thinking is a process through which individuals generate ideas that are simultaneously novel and meaningful within a given social context. Historically, psychologists have closely studied the general creative capacity of young learners, as well as the domain-specific creativity of experts. However, the developmental trajectory from children's general creativity to experts' domain-specific creativity remains largely unmapped. In this article, we work to address this issue theoretically by drawing on one established conceptual framework of academic development, the Model of Domain Learning (MDL). The MDL contains specific hypotheses about how learners' declarative and procedural knowledge, motivation, and performance within a domain change as they learn, and we here delineate our hypothesized ways in which creative thinking could be expected to concomitantly progress throughout that development. We suggest that domain creative thinking develops from a largely self-referenced process when domain knowledge is low to a more highly socially-referenced process as domain knowledge grows. In addition, we argue that creativity can both support and be supported by domain learning and offer specific suggestions for incorporating creative thinking into instruction at each stage of domain learning. We also show that, as learners develop academically within a domain, creative thinking requires a progressively greater investment of time and effort, which contributes to the riskiness of creative innovation and the rareness of creative experts.



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### **The outcome of the research:**

Educators need to understand that creativity manifests itself very differently in childhood and in adulthood. In childhood, creativity is a general attribute associated with playfulness, curiosity, and autonomy. But, as individuals learn and develop expertise, their creativity is channeled into their chosen domain. Then, creativity is a much more specific process that requires understanding what others in the field know and do not know. Only through understanding the norms of a particular profession can an expert then break those norms to innovate and invent.

# Thalia R. GOLDSTEIN

## High School Theatre Classes as a Laboratory for the Creative Process

Theatre and the performing arts have long been thought of as creative acts, but little work has previously investigated what kinds of activities and mindsets in theatre and acting classes may be related to learning the creative process and bolstering divergent thinking outside of the stage. In a 3 year, nationally representative observational study of high schools in the United States, we recorded 56 hours of acting classes for teenagers (age 13-18) across public, private, conservatory, general, and magnet schools. We then analyzed these classes both for the activity types in the classrooms and the Habits of Mind, or problem-solving approaches and mindsets, that the teachers were teaching. Among several other findings related to social skills, collaboration, metacognition, and body awareness, we found distinct connections to learning the creative process in two ways. First, the “generative” or improvisational section of classes (approximately 25.4% of class time, with a range from 5-58% of class time) involved students’ coming up, rapid-fire with words, actions, ideas, and characters with a sense of playfulness and freedom. This section of the class was practiced in on-the-spot divergent thinking with low consequences and high motivation. Second, the Acting Habits of Mind being integrated, used, and bolstered in classes included “be flexible,” “commit to choices” and “reflect and think meta-cognitively” each of which set students up to evaluate acting scripts, come up with multiple solutions, try them out, and then evaluate their success. These are all skills directly tied to the creative process of idea generation, evaluation, and application. This study opens the door to research on when, for whom, and how teachers and educators can bolster students’ creativity through the use of acting exercises and drama classes.



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### The outcome of the research:

“Why Theatre Education Matters” book to be published by Teacher’s College Press, July 26, 2024; a companion website with resources, toolkits for teachers, example videos, and executive summary for public and stakeholder dissemination available at [TheatreEdMatters.com](https://TheatreEdMatters.com)

# Jean Christophe GOULET PELLETIER

## Do students motivated to learn have better creative abilities?

Despite the key role that motivation plays in the creative process with respect to engaging with content, exploring, and learning, surprisingly, few studies have investigated the relationship between academic motivation and indicators of creativity. The objective of the current study was to clarify this relationship. We examined the role of openness to experience and academic motivation in relation to subjective and objective indicators of creative abilities. We hypothesized that openness to experience would predict greater intrinsic academic motivation, which in turn would predict better divergent thinking abilities and self-ratings in academic activities. Regression and mediation analyses with a sample of 279 college students supported the hypothesis that openness to experience was positively associated with intrinsic academic motivation. In turn, intrinsic academic motivation was related to higher creative self-ratings in academically related activities but not to better divergent thinking abilities. Additionally, controlled academic motivation was associated with poorer divergent thinking abilities.



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### The outcome of the research:

The results suggested that students with greater motivation to learn in school had no better creative abilities, as measured with divergent thinking tasks, but perceived themselves as more creative in academically related activities. We discuss the place of creative abilities in education and the distinction between a motivation to explore and a motivation to learn within the academic context.

# Jessica HOFFMANN

## **Creativity and Connection: The Impact of InspirED with Secondary School Students**

The World Economic Forum predicts that the skills most highly valued by employers in 2025 will be problem-solving, self-management, working with people, and technology use and development. Educators are seeking ways in which to incorporate these skills into their daily instruction. Here, we offer one possible approach to bolster skills in each of these domains: the inspirED program. inspirED was designed for U.S. middle and high schools to support teams of students in completing projects or campaigns that they believe will make their school a better place for all. This study enrolled teams of students from 22 middle and high schools, and provided them with online training, coaching in the inspirED process, and resources to complete their project.



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### **The outcome of the research:**

Upon finishing their projects, students on the inspirED teams reported a higher sense of purpose and self-awareness around the importance of emotions. The larger student bodies at schools in which inspirED projects took place also reported improvements in school climate including students' perceptions of teaching quality, sense of school pride, student relationships, and emotional safety. Implications and future directions for school-based social-emotional learning and student leadership opportunities are discussed.

## **The role of originality, distancing, and tentative language in effective cognitive reappraisal among adolescents**

Recent evidence from studies of adolescents suggests that the association between cognitive reappraisal, a well-studied emotion regulation strategy, and well-being may be contingent upon the successfulness of reappraisal attempts. To better determine how adolescents can generate more perceived effective reappraisals, the current study sought to evaluate the originality and linguistic elements of specific reappraisals, including their collective and independent associations with rated regulatory efficacy. We had two goals: 1) assess the relative association between originality, linguistic distancing, and tentative language and rated reappraisal efficacy; 2) evaluate the association between these specific reappraisal components and regulatory efficacy above and beyond general emotion regulation knowledge. Participants ( $n = 711$ ; 50.8% female, 49.2% male; 15-17 years of age, mean 15.82,  $SD = 0.74$ ) completed a measure of emotion regulation knowledge and a measure of creative cognitive reappraisal.

### **The outcome of the research:**

Above and beyond the variance accounted for by emotion regulation knowledge scores, both more original reappraisals and more temporally distanced language were associated with higher levels of perceived effectiveness. The use of social distancing and tentative language were negatively associated with rated reappraisal efficacy. Originality, distancing, and tentativeness were simultaneously significant, suggesting that they account for unique variance in reappraisal effectiveness.

# Weiping HU

## Increasing Students' Scientific Creativity: The "Learn to Think" Intervention Program

The "Learn to Think" (LTT) Intervention Program was developed to raise the thinking abilities of primary and secondary school students. It has been implemented in more than 300 schools, and more than 200,000 students took part in the experiment over 10 years. Several longitudinal intervention studies showed that LTT could promote the development of students' thinking ability, learning motivation, and learning strategy as well as raise academic performance in primary schools. This article describes a study of the influence and the delayed effects of LTT on the scientific creativity of secondary school students. One hundred and seven students were selected from a secondary school; 54 of them participated in the LTT every 2 weeks and the rest had not. The intervention lasted 2 years, and the delayed effect was explored half a year after terminating the intervention. The Scientific Creativity Test for Secondary School Students was used four times from pre-test to delayed post-test. The results indicated that the LTT did promote the development of scientific creativity of secondary school students, and the effects on scientific creativity were not necessarily immediate but tended to be long-lasting.



 **China**

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### The outcome of the research:

The study delves into the effects of the "Learn to Think" intervention program on improving scientific creativity in primary and secondary school students, underscoring the significance of incorporating creative thinking exercises into the educational framework.

## **The influence of teaching methods on creative problem finding**

Problem finding is an important component of creativity, but research on it does not offer much guidance to teaching. The present research takes a step in that direction with two investigations. The first was a between-subjects evaluation of a short-term classroom teaching process, using creative Chinese problem finding (CCPF) to assess the impact. The second was a long-term, mixed-design of creative scientific problem finding (CSPF) as it developed in response to teaching that emphasized problem finding. Results showed that there were improvements, but different teaching methods had varied impacts on students' creative problem-finding (CPF) performance. A mixed teaching method that included both lecture and inquiry-based teaching was superior to the lecture-based or inquiry-based methods when used separately. The mixed teaching showed the strongest improvements in students' flexibility and originality on the problem-finding tasks. Finally, there was a significant interaction between teaching methods and instructional type (opened, closed) in the flexibility and originality of CPF. Practical implications and limitations are discussed.

### **The outcome of the research:**

It highlights the importance of using a mixed teaching approach that combines lecture-based and inquiry-based methods to enhance students' creative problem-finding skills.



## **Curriculum Innovation in Times of the COVID-19 Pandemic: The Thinking-Based Instruction Theory and Its Application**

At the beginning of 2020, to stop the spread of the coronavirus disease (COVID-19) to the campus, the Ministry of Education of China launched a policy “Suspension of classes without suspending schooling” for the spring semester of 2020. However, the drawbacks of online teaching (e.g., students’ inadequate autonomous learning, and the lack of effective online instruction) forced us to modify teaching strategies during this special period, especially developing courses that are suitable for student learning at home and improving their key competencies. In order to solve these problems, this study introduces some theoretical exploration and practical work of curriculum design under the guidance of thinking-based instruction theory (TBIT) during the pandemic. We first introduce TBIT and elaborate on the curriculum design under the TBIT theoretical frame. Then we describe a series of TBIT-based micro-courses with the pandemic as background. A descriptive study is reported to illustrate the effects of three micro-courses. Results showed that, compared to national curricula, the TBIT-based micro-courses not only improved the course quality but also enhanced students’ motivation and facilitated their online learning behavior (such as interactive communication) for the online courses. The current study has important implications for how to design effective and interesting online courses suitable under the pandemic and capable of improving students’ thinking abilities and key competencies.

### **The outcome of the research:**

The research explores the application of Thinking-Based Instruction Theory (TBIT) in designing online courses during the COVID-19 pandemic, aiming to enhance students’ thinking abilities and key competencies while improving course quality and online learning experiences.

## **The influence of CASE on scientific creativity**

This paper describes a study of the influence of the Cognitive Acceleration through Science Education (CASE) program on the scientific creativity of secondary school students. 1087 pupils from six suburban mixed comprehensive schools in England took part in the investigation. Three of the schools had participated in the CASE program and three had not. Samples of students in years 7-11 from each school were given the Scientific Creativity Test for Secondary School Students, an instrument designed to tap various aspects of scientific creativity. The results indicated that the CASE program did promote the overall development of scientific creativity of secondary school students, although the effects on different aspects of scientific creativity varied. As expected from previous work on the delayed effects of CASE on academic achievement, the results indicated that the effects on creativity were not necessarily immediate, but tended to be long-lasting. Possible interpretations of these results are discussed.

### **The outcome of the research:**

The research investigates how the Cognitive Acceleration through Science Education (CASE) program influences the scientific creativity of secondary school students, shedding light on the pedagogical implications of the program.

## **Effects of a critical thinking skills program on the learning motivation of primary school students**

Learning motivation has a significant effect on student learning, which is a key determinant of academic performance and creativity. It is increasingly popular and important to cultivate learning motivation in schools. To consider this trend, a long-term intervention program named "Learn to Think" (LTT) was designed not only to improve students' thinking ability but also to improve their learning motivation. The present study explored the effects of the LTT curriculum on primary school students' learning motivation. The sample consisted of 158 Chinese primary school students, who were randomly assigned to experimental and control groups. Experimental students participated in the LTT curriculum for 4 years, with data collected via pretests, annual end-of-year assessments, and a delayed posttest administration 1 year after terminating the training. The results suggest that LTT had long-term transfer effects on the development of primary school students' learning motivation, especially on deep motivation.

### **The outcome of the research:**

The study investigates how the learning motivation of primary school students, particularly deep motivation, is impacted by a Critical Thinking Skills Program known as "Learn to Think."

## **A scientific creativity test for secondary school students**

This study describes the development of a test of scientific creativity for use with secondary school students. A Scientific Creativity Structure Model (SCSM) was constructed on the basis of an analysis of meanings and aspects of scientific creativity found in the literature. 50 science teachers in China took part in an initial evaluation of this model. On the basis of their analyses and comments, and drawing on the experience of the Torrance Tests of Creative Thinking, a 7-item scale for measuring the scientific creativity of secondary school students was developed and validated through analyses of item response data of 160 secondary school students in England. Item analyses were conducted to check on item discrimination, internal consistency, agreement between scorers, construct-related validity, and face validity. Analysis showed adequate reliabilities and validities. As an example of how the test might be used, data from the pilot use of the test were used to investigate the relative scientific creativity of students of different ages and ability levels. The results indicated that for this trial sample, the scientific creativity of secondary school students increases with an increase in age, and science ability is a necessary but not sufficient condition for scientific creativity. Further work is also suggested.

### **The outcome of the research:**

The research led to the creation and validation of a 7-item scale designed to measure scientific creativity in secondary school students. The scientific creativity test for secondary school students holds educational significance in evaluating and fostering scientific creativity.

# Sara JONES

## **Skillful Coping with Unorder: Educating 21st Century Arts Leadership**

This paper first addresses why innovative learning approaches are needed for 21st-century leadership education in the arts and cultural sector, then moves on to a case study of how such approaches are being implemented in practice, in the Boosting Resilience project. The approaches taken here are characterized as involving a multi-disciplinary consortium of delivery partners; the use of constructivist pedagogy that draws on arts-based methods of delivery; a participatory and agile learning design process; and the incorporation of on-going evaluation activities, that are woven into the process of design. The paper concludes with some discussion regarding the potential generalizability of approaches such as those employed on the Boosting Resilience project to arts and cultural leadership education more broadly.



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### **The outcome of the research:**

The feedback we received on the Boosting Resilience program was overwhelmingly positive, with one participant describing it as 'life-changing' and another explaining that '[the residential] was one of the most inspiring pair of days I've had in a very, very long time. I feel genuinely motivated to explore, deepen, consider, and act'. Another participant explained: 'It's become a new way of thinking, acting and progressing in both work and beyond. The embedding of ideas and rationale is quite extraordinary and certainly liberating. The concept of being immersed in great company for a residential certainly works.'

# Yoed KENETT

## Education shapes the structure of semantic memory and impacts creative thinking

Education is central to the acquisition of knowledge, such as when children learn new concepts. It is unknown, however, whether educational differences impact not only what concepts children learn but how those concepts come to be represented in semantic memory—a system that supports higher cognitive functions, such as creative thinking. Here we leverage computational network science tools to study hidden knowledge structures of 67 Swiss schoolchildren from two distinct educational backgrounds—Montessori and traditional, matched on socioeconomic factors and nonverbal intelligence—to examine how educational experience shapes semantic memory and creative thinking. We find that children experiencing Montessori education show a more flexible semantic network structure (high connectivity/short paths between concepts, less modularity) alongside higher scores on creative thinking tests. The findings indicate that education impacts how children represent concepts in semantic memory and suggest that different educational experiences can affect higher cognitive functions, including creative thinking.



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### **The outcome of the research:**

The non-traditional schooling system enriched children's memory so that it was more flexible, and in parallel, they were more creative, possibly as a result.

# Anatoliy KHARKHURIN

## **PICK: Plurilingual Intercultural Creative Keys**

We present a new pedagogical system, "Plurilingual Intercultural Creative Keys" (PICK: <https://pick.hse.ru/en/>), aimed to form an individual's systemic adaptation by developing creative, intercultural, and linguistic competencies. Over the past 25 years, empirical studies convincingly demonstrated the interrelation between these three competencies. Recent findings within the framework of the plurilingual creativity paradigm demonstrated how these competencies influence individuals' personal and cognitive qualities underlying their adaptability to the modern world. The PICK system adopts a holistic approach encompassing curricular, psychological, and socio-cultural aspects of the educational environment. It modifies the learning process without altering the curriculum. This goal is accomplished by changing a teacher's pedagogy. We nurture the key competencies in teachers and equip them with solid theoretical and methodological knowledge, which would drastically modify their pedagogical approach. The PICK system includes three teacher training modules focusing on creative, intercultural, and linguistic competencies. This training is complemented by three blocks of lectures and workshops, assisting teachers in developing students' intrinsic motivation, establishing a favorable psychological climate, and optimizing students' classroom activities. Finally, during the implementation of PICK techniques, teachers receive psychological and methodological support from the PICK experts who comprehensively monitor the implementation progress.



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### **The outcome of the research:**

Teachers possess strong theoretical and methodological knowledge, allowing them to develop creative, intercultural, and plurilingual competencies, which significantly alters their pedagogical approach.

# Clin LAI

## Fostering Creativity in Science Education Reshapes Semantic Memory

In the evolving landscape of 21st-century education, nurturing creativity emerges as an essential skill for addressing contemporary challenges. This study explores the effects of an educational intervention, the Scientific Creativity in Practice (SCIP) program, aimed at enhancing creativity among students aged 10-18 ( $n = 176$ ) within a chemistry class context. According to associative theory, creative thinking stems from the ability to forge connections between seemingly unrelated concepts within semantic memory. Students completed creative thinking tests, as well as verbal fluency tasks, to estimate semantic memory networks in science-specific (chemistry) and domain-general (animal) categories. By integrating this program into the chemistry curriculum, the study seeks to investigate the transformation in students' semantic memory networks, shedding light on how educational interventions can effectively foster creativity by reorganizing knowledge in a way that facilitates novel associations.



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### **The outcome of the research:**

The study found that the SCIP creativity intervention significantly increased fluency scores in creative thinking tests and led to a significant restructuring of semantic memory networks. This reorganization manifested as increased interconnectedness and a 'small-world' network characteristic within both science-specific and domain-general contexts, particularly within the chemistry domain, aligning with the SCIP's focus. These findings underscore semantic memory reorganization as a potential cognitive mechanism through which science education interventions can successfully cultivate creativity.



# Todd LUBART

## Measure of creative potential in children and adolescents

This line of work, which began 25 years ago, has led to the creation of a battery of measures of creative potential in children and adolescents. Creative potential refers to the capacity to engage in original, productive thinking in a content domain. In this battery, for each content domain (graphic-artistic, verbal-literary, social problem solving, math, science, music, and body movement), there are two kinds of tasks to complete. First, a divergent-exploratory task, in which the child/adolescent is asked to generate as many different, original ideas as possible in reply to a stimulus, such as a pictured object, the start of a story, etc. In the second kind of task, convergent-integrative, the child/adolescent receives several elements, such as three pictures of objects or three story characters, and must propose an elaborated new idea synthesizing those elements. The battery is called EPoC, meaning Evaluation of Potential Creativity. It has been normed in France, Slovenia, and is in the norming process in several countries. Versions exist in numerous languages (English, French, Spanish, German, Portuguese, Turkish; Arabic, Chinese, ...).



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### The outcome of the research:

There are four main uses in educational contexts: (a) the battery as a pre- and post-test can allow educators to measure the impact of a program designed to enhance creativity, (b) the battery can help educators identify the strengths and weaknesses of each student to provide relevant activities to develop creativity, (c) the battery can allow educators to identify high creative potential (creative giftedness) for special programs, (d) the battery provides a measure of creative potential that can be used in research and related to other variables of interest to educators, such as school grades, learning styles, personality traits, pedagogies.

# Margaret MANGION

## Young Creators: Perceptions of Creativity by Primary School Students in Malta

Policymakers and employers insist that educational institutions prepare workforce-ready candidates fluent in the application of 21st Century skills such as creativity. So far, only a few studies have explored the self-perceived creativity of students. This paper addresses this gap in the literature by providing an understanding of how young students in upper primary feel about themselves as creative beings. Data for the present study was collected through an anonymous online survey that 561 students aged 9-11 years and residing in Malta (EU) completed. In-depth responses were collected from a subset of the original sample made up of 101 students through an anonymous online form containing a set of questions. Data was analyzed using regression analysis for the quantitative component and through thematic analysis for the qualitative part. Results indicate that, overall, students in Year 6 felt less creative than students in Year 5. Furthermore, findings show that the type of school attended impacted the students' perception of creativity. From a qualitative perspective, findings led to insights into (i) the interpretation of the term creativity and (ii) the impact of the school environment and how timetabling impacted students' creativity. The findings suggest that the student's perceived creative personal identity and the concrete manifestations that they engage in are influenced by environmental factors.



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### **The outcome of the research:**

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# Maxence MERCIER

## The effects of board games on creative potential

The current study aimed to investigate whether board games could be used to improve creative potential. Games have proven to be effective learning tools, and some studies have indicated positive links between creativity and other types of games, namely video games and role-playing games. However, little is known regarding board games' potential benefits on creativity. This exploratory study compared two types of board games: creative and non-creative board games. We used a within-subject repeated-measurement design, in which participants played both types of games across two sessions separated by one week. We assessed creative potential with a divergent thinking task, using fluency and originality as indicators. We controlled openness, mood states, and enjoyment.



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### The outcome of the research:

Results suggest an improvement in originality after playing both types of games, whereas no differences were observed for fluency. Considering the base level of participants, we found improvement for low-performing participants, specifically, in both fluency and originality, although analyses with limited statistical power may have impacted the findings. These findings provide a first step in the study of creativity and board games and suggest they could help temporarily improve one's divergent thinking capacity.

# Angie L. MILLER

## Exploring the role of gender identity and academic major in creative confidence and unconventional career plans

Entrepreneurialism is an increasing trend in career choices. While confidence in certain skills can help combat the complexity of these new roles, gender identity and major may also influence self-beliefs and career plans. This study utilizes survey data from the 2019 and 2020 administrations of the National Survey of Student Engagement (NSSE), with a sample of 74,572 seniors at 264 higher education institutions. Ordinary Least Squares (OLS) regression analyses were used to explore the relationship between student and institutional characteristics (with a particular focus on gender and major) and confidence in creative thinking and entrepreneurial skills. Binary logistic regression models were used to determine the predictive power of the student identities and institutional characteristics, along with creative and entrepreneurial confidence, for future plans for self-employment and starting a business. Results from the OLS regression models suggest that even after controlling for demographic and institutional characteristics, gender identity and major predict confidence in creative and entrepreneurial skills. Furthermore, the logistic regression models suggest that gender identity, major, and skills confidence are also predictors of plans for self-employment and starting a business.



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### **The outcome of the research:**

The findings demonstrate the need to address certain gaps through educational interventions, including increasing confidence for women and among arts and humanities majors.

## **Does creative coursework predict educational, career, and community engagement outcomes for arts alumni?**

This study explores how exposure to creative coursework during one's education can influence a variety of educational, career, and community involvement outcomes for arts alumni. Data were drawn from over 40,000 undergraduate-level arts alumni from the 2015, 2016, and 2017 administrations of the Strategic National Arts Alumni Project (SNAAP). A series of ordinary least squares and binary logistic regression models (controlling for relevant demographic characteristics) suggest that exposure to creative coursework is a significant predictor of several desirable outcomes. Specifically, the analyses suggest significant effects of exposure to creative coursework on the following: creative skills gained during time at the institution, sense of connection to one's institution, time until first job after graduation, relevance of first job after graduation, relevance of training to the current occupation, current income, current occupational field, and arts community involvement. However, the magnitude of these effects was often small, and limitations are discussed.

### **The outcome of the research:**

Overall, these findings can help to support curricular changes that encourage the increased use of creative activities and assignments in higher education, as well as provide accountability

# Solange MUGLIA WECHSLER

## Integrated assessment of intelligence and creativity: Construction and validation of a battery of tests in digital format

The assessment of intelligence is a well-known tradition in psychological testing. However, creativity has rarely been assessed in traditional intelligence testing, thus limiting the complete evaluation of an individual's full range of abilities, as a creative person. As we know, the creative person goes beyond the correct answer provided in most tests, thus being penalized when only intelligence is being valued. Considering the importance of combining these two constructs, the purpose of this research is to construct and validate a battery for assessing Brazilian children's creativity and intelligence (BAICI). The objective is to have group-administered tests in digital format to be able to identify cognitive potential on a large scale instead of time-consuming individual tests. BAICI is composed of 5 intelligence tests measuring verbal abilities, memory, logical thinking, speed of reasoning, and visual motor skills, and one creativity test measuring figural and verbal creativity. The printed version of this battery was already validated with Brazilian children who were nominated as gifted by their teachers. The digital format of BAICI is being elaborated. The total sample for this project will involve 750 children, both sexes, ages 9-13, from public and private schools from 5 Brazilian regions. Item difficulty will be analyzed for these children. Evidence of validity, by comparing with external variables, that is, tests that were already validated measuring the same areas, although independently and in printed format, will also be collected. Confirmatory analysis will be used to interpret the results.



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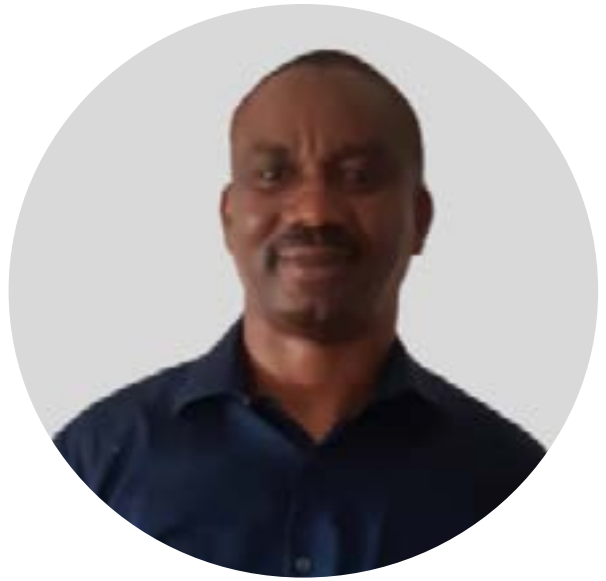
### The outcome of the research:

As a result of this research, it is expected to have a valid battery of tests to assess creativity and intelligence in Brazilian children. Transcultural studies will also be possible with BAICI as well since the digital format would be accessible to other researchers.

# Felix-Kingsley OBIALO

## Psycho-Social factors and Creativity of Undergraduates in South-West Nigeria

The fact that the individual is at the center of creative expression continues to influence studies that focus on the individual and their roles in the quest for a more creative society. In an attempt to grow and develop, Nigeria relies on the graduates of higher institutions, especially the universities, to supply the pool of leaders that would utilize creativity for developmental goals. This agrees with the universal trend that makes university graduates the fulcrum on which a nation's workforce is built. The concern is whether these future leaders possess the qualities that would facilitate the nurturing of creativity. Eight psychosocial variables (knowledge of creativity, attitude towards creativity, risk-taking behavior, parental influence, age, peer pressure, gender, and course of study) that are peculiar to the conditions of undergraduates and might influence creativity were examined. Three valid and reliable instruments were designed, and another were adopted to survey participants. Multistage sampling was used to sample 651 respondents (330 females and 321 males).



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### The outcome of the research:

Six psychosocial factors (knowledge of creativity, attitude towards creativity, risk-taking behavior, parental influence, age, and course of study) significantly correlated with creativity in that order. Findings portend hope for the Nigerian search for a more creative set of graduates and workforce. The study articulates suggestions for stakeholders in the educational system in the hope that the Government at all levels will facilitate a nurturing environment for creativity among the country's undergraduates.

## **Teacher-Student Perception of Humor, Playfulness, and Creativity on Student Learning Outcome in Ibadan, Nigeria**

The use of humor, playfulness, and creative learning seems to be unpopular in the Nigerian educational system. This study documents the perceptions of teachers and students of secondary schools in Ibadan, Nigeria, on the role of humor, playfulness, and creativity/creative learning in the classroom. Focus group discussions were conducted with 48 teachers and 50 students. Participants were asked about their knowledge of and attitude toward the variables.

### **The outcome of the research:**

Constant comparison analysis or method of constant comparison revealed that the teachers have a good knowledge of the roles of the variables in the classroom. However, factors like pressure to complete the syllabus, competition among schools in external examinations and the like, promotion of one right answer to every problem, and fear of losing respect before students inhibit the use of these variables in the classroom by teachers. The students believe that the variables bring quarrels and distractions among students even though they help academic achievement. The outcomes suggest a strong dominance of cultural influence, which effectively affects acceptance in practice of the benefits of the variables in the teaching-learning process. Policymakers and government must, therefore, train teachers in the deliberate utilization of playfulness, humor, and creativity/creative learning in the teaching-learning process.



## **Preventing Youth Substance Use Using Creative Problem Solving-Cognitive-Behavioral Skills Enhancement Approach**

The purpose of this study was to assess the effectiveness of a creative problem-solving-cognitive behavioral skill enhancement approach to the prevention of substance use among youth. Study Design: A quasi-experimental study was used. Methods: The study involved 327 youth (mean age  $19.1 \pm 3.4$  years) of the Catholic Archdiocese of Ibadan, Nigeria in various secondary and tertiary institutions across Nigeria who gathered for an annual program. A self-reporting questionnaire was administered pre and post-eliciting information about participants' demographics, knowledge of the effects of the substance on the brain, attitude towards substance usage, decision-making behavior, satisfaction about the training/resolve to share information acquired, and creative problem-solving skills. 327 participants completed the pre-test, but 208 (mean age  $19.2 \pm 2.9$ ) completed the post-survey. This accommodated a cross-sectional analysis of the results. Results reflect a comparison of all pre-evaluations with all post-evaluations. This prevented a pre- and post-evaluation paired-test analysis.

### **The outcome of the research:**

There is a significant difference in each post-assessment result of the variables among participants: knowledge of how the brain helps make decisions  $p(0.001) < .05$  level of significance; attitude towards substance use  $p(0.003) < .05$  level of significance; decision-making  $p(0.005) < .05$  level of significance; satisfaction and willingness to share information and skills acquired with friends  $p(0.003) < .05$  level of significance; creative problem-solving skills  $p(0.002) < .05$  level of significance. Conclusion: A combination of creative problem-solving and cognitive-behavioral skills enhancement influenced youth's decision against substance use. The result suggests that the enhancement technique is appropriate, effective, and feasible for youth deterrence from substance usage encouraging further research.

# Takeshi OKADA

## Imitation, Inspiration, and Creation: Cognitive Process of Creative Drawing by Copying Others' Artworks

To investigate the cognitive processes underlying creative inspiration, we tested the extent to which viewing or copying prior examples impacted creative output in art. In Experiment 1, undergraduates made drawings under three conditions: (a) copying an artist's drawing, then producing an original drawing; (b) producing an original drawing without having seen another's work; and (c) copying another artist's work, then reproducing that artist's style independently. We discovered that by copying unfamiliar abstract drawings, participants were able to produce creative drawings qualitatively different from the model drawings. Process analyses suggested that participants' cognitive constraints became relaxed, and new perspectives were formed from copying another's artwork. Experiment 2 showed that exposure to styles of artwork considered unfamiliar facilitated creativity in drawing, while styles considered familiar did not do so. Experiment 3 showed that both copying and thoroughly viewing artwork executed using an unfamiliar style facilitated creativity in drawing, whereas merely thinking about alternative styles of artistic representation did not do so.



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### **The outcome of the research:**

These experiments revealed that deep encounters with unfamiliar artworks—whether through copying or prolonged observation—change people's cognitive representations of the act of drawing to produce novel artwork. This study offers useful suggestions for art education by showing that artistic creativity can be facilitated through deep encounters with something outside of one's repertoire.

# Connie PHELPS

## Educational Engineer of Creative Classrooms: Frank E. Williams and the Creatively Gifted

This study investigated the relationship of the Williams Cube Model designed to train classroom teachers in creative behaviors and its applications for creatively gifted students. Drawing on the work of J. P. Guilford's Structure of Intellect, Frank E. Williams designed a three-dimensional cube model incorporating Subject-Matter Content, Productive-Divergent Thinking Processes, and Teaching Strategies dimensions to deliver, plan, and evaluate cognitive and affective factors of creative behaviors in elementary school classrooms. Incorporating elements from Bloom's Taxonomy, Piaget's Stage Theory, and Hierarchical Schema, the three Williams Cube dimensions formed 864 categories of cognitive-affective behaviors in the classroom. Implemented during post-Sputnik educational priorities, the Williams Cube supported a movement of educational engineering for creative classroom behaviors concurrent with the rise of gifted education in American schools. By adapting instructional planning of effective teachers for creative behaviors, schools applied creativity research to develop creative potential in all students, including the gifted, talented, and creative with their distinct cognitive and affective characteristics and needs. Using the morphological dimensions of the Williams Cube, teachers learned to identify, support, and evaluate multiple domains of creative classroom behaviors. The three-dimensionality of the cube provides systematically differentiated instruction based on individual student interests, advanced abilities, and need for complexity.



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### **The outcome of the research:**

Teacher training in the three Williams Cube model dimensions supports differentiated instruction for the creatively gifted by developing their capacity for productive-divergent thinking and feeling processes within specific academic content areas in schools. Educational engineering occurs by implementing teaching strategies in academic subjects with an emphasis on creative behaviors in classrooms.

# Jeb PURYEAR

## Creativity Knowledge of Practicing Teachers: Predictors and Correlates

Creativity is routinely articulated as a goal of education, yet teachers struggle to support it in the classroom. Building on previous studies examining the prevalence and predictors of neuromyths and creativity myths, researchers investigated the level of scientific knowledge about creativity within a sample of practicing educators ( $n = 219$ ). Results suggested knowledge differences between teachers and the general population, generally reinforced previous findings with respect to predictors of scientific knowledge about creativity, and demonstrated the importance of creativity knowledge as a predictor of supporting a creativity-education link. Implications for teacher access to scientific knowledge and creativity training are discussed.



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### The outcome of the research:

This study replicated Benedek et al.'s (2021) study on creativity knowledge, finding largely similar endorsement levels for myths and facts among teachers when compared to the general population. Teachers recognized creativity in diverse subjects but exhibited a naive conception and lower endorsement of creativity in practice. Predictors of endorsement included postgraduate education and authoritative information sources, whereas creative self-identity had a weak influence. Notably, higher creativity knowledge correlated with increased support for linking creativity and education, suggesting knowledge plays a crucial role in fostering creativity-supportive environments.

This study underscores critical needs in research-practice connections and future endeavors: gatekeeping/access and research-based training. Effective communication between stakeholders is crucial. To combat pseudoscience, the practice of scientific gatekeeping must be eliminated, ensuring accessibility to evidence-based instruction. To meet knowledge goals, scientific evidence should transcend paywalled journals, reaching a wider audience through clear communication tailored to different stakeholders. Researchers can dismantle barriers and collaborate with practitioners and media outlets to disseminate findings effectively. Additionally, evidence-based training is vital for progress. Although teacher training often lacks a focus on creativity, studies show positive outcomes from creativity training, linking it to increased creative self-efficacy and improved alignment with research-supported conceptions. The integration of research and training is key for advancing both fields and bridging the creativity gap in education.

# Margarida ROMERO

## Interactivity and materiality matter in creativity: educational robotics for the assessment of divergent thinking

Idea generation in interactive learning environments requires the consideration of the interactivity and materiality aspects of creativity. In educational robotics, idea generation is mediated through a technological object in a process allowing us to observe the three main components of divergent thinking: fluency, flexibility, and originality. Nevertheless, divergent thinking assessment has been mainly evaluated in the last decades through semantic idea generation tasks such as the Alternative Uses Test (AUT), asking participants to write different uses for familiar objects. In our study, we aimed to analyze differences in the three divergent thinking components (fluency, flexibility, and originality) through the AUT as a semantic task and through an educational robotic task that engaged the participants in building their ideas interactively. Results show that the creative components are strongly correlated within but not between the two tasks, leading us to consider the differences in the creative processes engaged when generating ideas through building with robotic objects. The role of affordances in idea generation through educational robotics is discussed as an important difference to consider in the evaluation of creativity in interactive learning environments.



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### The outcome of the research:

Participants that took more time to solve the CreaCube task had a higher score on fluency, flexibility, and originality. The time of completion of the activity was correlated with the detection time of the switch button. The faster the participants found this button, the faster they finished the activity. This correlation highlights the importance of object affordances in the completion of a manipulative task. The detection time of the switch button was correlated with the detection time of the wheels, suggesting the existence of different profiles in the understanding of the perceptual characteristics of the objects. Finally, the correlation between the switch button detection and the fluency score, i.e., the total number of structures created by the participant, might be interpreted as a trial-and-error behavior, in which the user develops many tests with excessive manipulation without really paying attention to the object and technological affordances. This, therefore, highlights an important but non-productive activity. Overall, these results suggest that success in manipulative problem-solving was more correlated with the time at which the object affordance was detected than with the DT creative components.

After having analyzed the AUT and the CreaCube tasks independently, the next section compares these two tasks, aiming to explore the link between DT creative components in a written-based idea generation (the AUT task) and in a manipulative building task (the CreaCube task). For this purpose, we explored whether the fluency, flexibility, and originality scores for AUT were correlated with those same components for the CreaCube task. This comparison might allow us to explore the differences in creative components depending on the type of tasks performed.

# Mônica SOUZA NEVES PEREIRA

## **Creativity and blackness: how black students understand the construction of their creative processes at public university.**

Blackness is a topic of human, political, social, economic, and ethical interest, little faced in rich and medium-sized countries, where stories of enslavement and racism haunt people, showing the potential for the perversity of our species. The black population has historically experienced atypical situations in the personal, sociocultural, political, economic, and ideological spheres, resulting from prejudices of all kinds, where racism finds fertile ground to grow and bear fruit. Patriarchy and racism, with their sinuous and subliminal movements, made the lives of black people unattractive for the sciences, in general. This rescue has been carried out for some decades now, with areas of scientific research questioning the reason for this abandonment of the human issues of blacks and other social groups in a minority situation. Regarding the investigation of the creative processes of black people, there are few records of studies interested in understanding and analyzing how this group experiences and develops their creative processes. In theory, there are no differences in the basic dynamics of human development for whites and blacks, but if we practice a cultural, dialogic, and semiotic psychology, we know that development processes are profoundly affected by socio-historical-cultural conditions, which marks the developmental trajectories of different individuals belonging to minorities of all kinds. This research is part of a larger study that has been working with the themes of blackness and the development of creativity since 2020. After conducting a literature review study in the area, the time has come to investigate how black students at a public Brazilian university , understand and signify their creative processes and the ways in which these processes are developed from autobiographical narratives and in-depth interviews with these participants. We want to analyze, in an interpretative and micro-genetic way, the social interactions experienced by black students in their study spaces and experiences at the university and how the semiotic/dialogical processes of I-Other-in-the-world mediate their creative process. Our study starts from a sociocultural, semiotic, and dialogical perspective of the creative processes. Keywords: blackness, creative processes, human development, racism



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### **The outcome of the research:**

The main results that emerged from this study show racism as a mediator of the creative processes of black students, including the violence and oppression experienced by these students. The fact that educational institutions are regulated by whiteness was also analyzed, placing permanent obstacles to the feeling of institutional belonging of black students and affecting the construction of the vision that young black people have of themselves. The university, still a space for financial and social elites, adopts the capitalist premises of excessive productivism, which places young black people at low standards of academic production since they do not have the social and economic support networks of young white people. Given this scenario, the creativity of black students is greatly affected by the context of racism, compromising the development of the creative potential of this social group. Creativity is not always able to overcome the barriers imposed on it, especially when its (black) agents are constantly dealing with prejudice and violence of all types.

# Paul SOWDEN

## Context, Knowledge, Agency, Pedagogies and Leadership for Creativity in Schools

We report the initial findings from a large-scale program that puts creativity at the heart of the school curriculum. Funded by Arts Council England, the University of Winchester, the University of Winchester Academy Trust, and a range of infant, junior, and primary schools are engaged in a three-year 'Creativity Collaborative' program, to foster pupils' creativity in subjects drawn from across the curriculum. The program aims to enrich children's life chances by developing them into confident & creative problem-solvers, engaging them through authentic, meaningful problems embedded in their schools & lives. The program comprises five interleaved streams of work: Context, Knowledge, Agency, Pedagogies, and Leadership for creativity. Context for creativity focuses on identifying barriers and enablers of learning and teaching for creativity in our participating schools and their interaction with inequality & disadvantage. Knowledge for creativity focuses on building learners', teachers' and leaders' knowledge and understanding of creativity. Agency for creativity focuses on supporting learners and teachers to develop their creative self-efficacy. Pedagogies for creativity focuses on developing evidence-based pedagogies to foster creativity, working with teachers, and pre-service teachers undergoing initial teacher education. Finally, leadership for creativity focuses on effective leadership, governance, and collaboration strategies to grow a climate for creativity and sustainable change. A key emphasis of our collaborative work is on creativity as a process that can be planned for and monitored, supported by a range of creative behaviors. This has led to the development of a framework that is being used across our schools to guide pedagogic approaches to teaching for creativity. Evidence of the impact of our workstream activities comes from a mixed-methods research approach comprising quantitative measures, focus groups, interviews, and teacher observation of creative outcomes in the classroom.



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### The outcome of the research:

We developed and implemented an approach to planning, teaching, and learning for creativity that combines creative habits of mind with models of the creative process and research on establishing a climate and culture for creativity in schools. The model was embedded in units of work in a broad range of subject areas with a range of beneficial impacts for pupils including greater engagement and learning, and the production of work that was both more original and that met the teacher's brief, and pupils' own self-defined success criteria. The approach also enabled vulnerable pupils, who might otherwise struggle to access the curriculum, to work more effectively with results beyond teacher expectations. School leaders identified a range of informal and formal strategies to support teacher agency with respect to teaching for creativity and to sustainably embed teaching for creativity into the very fabric and culture of practice across their schools.

# Katya STOYCHEVA

## Creativity and Personality

My research on creativity and personality focuses, among others, on creative motivation in adolescents and adults. Interest in and willingness to engage in intrinsically motivated exploration of and experimentation with new problems, novel ideas, and uncommon situations was supported by one's tolerance of ambiguity, lack of perseveration, and creative self-perception. Furthermore, our studies linked individual differences in creative motivation to several educational variables. Creative motivation does not relate to high school grades: though creative motivation and the need for achievement correlate positively, and high scorers in both dimensions are characterized by involvement in one's work and expenditure of time, energy, effort, and enthusiasm, it is the need for achievement and not creative motivation that directs them into achieving high-level school performance. University students enrolled in different fields of study differ in their creative motivation: art students and those enrolled in creativity courses at a novel university setting score higher. Academic training seems to have a lasting effect, as adults with a university education score higher than adults with up to secondary education, and this difference manifests in people of different ages.



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### **The outcome of the research:**

it points to the relevance of academic training to individuals' creativity-relevant attributes and supports the implementation of creative projects in education, as a way to harness one's creative motivation when striving to achieve results.



# Anastasia TAVARES VAN- DEN BERGHE

## **Becoming Mona Lisa: a comparative study exploring the impact of Neural Style Transfer in immersive art on creativity**

The advent of artificial intelligence (AI) has revolutionized the creative realm, not only by providing new resources for artistic expression but also by transforming the way people experience creativity. This study explores the intersection of creativity and AI, particularly focusing on the impact of participation of sixteen- to eighteen-year-olds in an AI-based interactive activity using Neural Style Transfer technology compared to those who passively observed artworks. Pre- and post-intervention changes in creativity levels between participants were assessed using the Torrance Test of Creative Thinking - Figural version. Our results demonstrate how the emergence of AI-based interventions can have both positive and negative effects on different aspects of creativity in teenagers. Specifically, our findings indicate that active participation in the installation enhanced participants' ability to remain open-minded and generate original ideas. However, it also had a negative impact on their elaboration skills.



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### **The outcome of the research:**

The results obtained from this study provide insights into how engagement with AI-powered tools can shape different aspects of an individual's creativity, offering valuable implications for their integration into educational contexts.

## **Exploring the Interplay between Creativity, Intelligence and Emotional State: Comparative Study Using Modular Robotics & Coding**

This study/work in progress aims to delve into the intricate relationship between creative cognition, intelligence, and emotions. While historically, intelligence and creativity have been perceived as separate constructs, recent research highlights the shared neural and cognitive systems underlying creative and intelligent behaviors. The advent of the field of STEM added another layer of complexity to this dynamic. Initial investigations into the influence of robots on human emotions suggest that interacting with modular robots offers a secure platform for emotional expression. Moreover, emerging research suggests that there is a connection between emotions and creativity, highlighting the need for a deeper understanding of these interactions. The goal of this study is to investigate the relationship between creative cognition, intelligence, and emotions by examining the impact of behavioral and cognitive manipulations through embodied (educational modular robotics) and disembodied interventions (coding).

### **The outcome of the research:**

The results have the potential to impact educational strategies and curriculum development by providing guidance to educators and policymakers in designing more effective interventions tailored to meet the cognitive and emotional requirements of students.

# Marek & Kamila

## URBAN

### **Metacognition Required: Planning, Monitoring, Regulating, and Evaluating to Creatively Solve Classroom Tasks**

In schools, we usually encounter two kinds of problems: those well-defined, with clear goals, procedures, and evaluation criteria (like puzzles and mathematical problems) and those ill-defined (like essays, projects, or design products). Our research investigates how students solve these ill-defined problems, with a specific focus on metacognition. Metacognition is the ability to plan, monitor, regulate, and evaluate your thinking processes, and we have found that accurate metacognitive monitoring is necessary for solving problems creatively (doi). However, we know that some students are unskilled in creative problem-solving and highly overconfident about their performance, some students are skilled and underconfident, and some students are unskilled but aware of their low performance (doi). Our latest mixed-methods study found that each of these groups of students is specific, and each requires a different attitude in classrooms (doi).



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#### **The outcome of the research:**

To solve creative tasks well, students need to use metacognition.

## **Motivation and Metacognition: Metacognitive Awareness Is Not Enough for Creativity Without the Will to Proceed**

Students who are metacognitively aware of their learning tend to be also more intrinsically motivated to learn and perform more creatively (doi). However, metacognition itself is not sufficient for creative performance to occur, intrinsic motivation mediates the relationship between metacognitive awareness and creativity (doi). In other words, students may be aware of what to do and how to do it (metacognitive awareness); if they do not care (intrinsic motivation), they will simply not do it anyway. Interestingly, intrinsic motivation is, again, not enough for creative performance itself. Students also have to perceive the value of creativity; they simply have to know why being creative is important (doi).

### **The outcome of the research:**

Being aware of how you think (metacognition) and wanting to learn (motivation) are both crucial for creativity, but neither is enough on its own; students also need to understand why being creative matters.

## **ChatGPT Enhances Creative Problem-Solving, But It Needs to Be Used Correctly**

In our most recent study (doi), we found that ChatGPT, a widely adapted generative AI tool, can help university students come up with creative solutions to complex ill-defined problems. We found that students who used ChatGPT felt more confident about solving problems, found the problems easier to tackle, and came up with better and more original ideas. However, even though ChatGPT helped in many ways, it didn't necessarily make the task more interesting for the students. Also, we noticed that some students using ChatGPT had a hard time judging how well they were doing on the tasks as they sometimes overestimated their performance, especially when they found ChatGPT very helpful or thought the task was easy. The following studies focus on how to use generative AI tools effectively from the perspective of hybrid human-AI regulation theory. In other words, we are interested in how different prompting or co-regulatory strategies boost performance most effectively.

### **The outcome of the research:**

Using ChatGPT can enhance students' ability to find creative solutions and boost their confidence, but to truly benefit, they need to learn the right way to use it.

# Kim VAN BROEKHOVEN

## Fostering University Students' Idea Generation and Idea Evaluation Skills With a Cognitive-Based Creativity Training

This paper examines the effectiveness of a 10-hour cognitive-based creativity training on idea generation and idea evaluation among 51 undergraduate students (mean age 22) from a large university in the Netherlands. A pre-post-test within-subject design was conducted. All 51 students received the training as part of their bachelor program and were assigned to receive the training in the first or second semester. As such, students participated in both experimental conditions (control and intervention), albeit at different times (within-subject design). The Alternative Uses Task (AUT) and specially designed idea evaluation tasks were used before and after the training. In the idea evaluation task, students were asked to evaluate ideas on their originality and feasibility. Their ratings were compared with content experts' ratings. General Linear Models (GLM) for repeated measures were conducted to determine whether any change in idea generation and idea evaluation is the result of the interaction between type of treatment (i.e. intervention or control group) and time (pre- and post-test). The results indicated that students did not generate significantly more (i.e. fluency) and different kinds of ideas (i.e. flexibility) after training. Most importantly, in line with recent research, the results suggested that training does not impact idea evaluation skills among students. This suggests that idea evaluation might be a more complex process to enhance than idea generation. The implications of these results for educational practice and future research are discussed.



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### The outcome of the research:

The results indicated that students did not generate significantly more (i.e. fluency) and different kind of ideas (i.e. flexibility) after training. Most importantly, in line with recent research, the results suggested that training does not impact idea evaluation skills amongst students. This suggests that idea evaluation might be a more complex process to enhance than idea generation.

## **Differences in creativity across Art and STEM students: We are more alike than unlike**

The aim of the present research is to investigate creativity differences and the magnitude and nature of those differences among university students. More specifically, we examined differences in creativity within and between: (a) General Thematic Areas (Art and Science); (b) Specific Science domains (STEM), and; (c) Engineering micro-domains, for a total of 2277 students in German tertiary institutions. The results showed many statistically significant, but uniformly small, differences at all levels, across a range of Person, Process, and Product variables. The pattern of results suggests that Openness, Creative Self-Efficacy and Divergent Thinking may be general pre-requisites for creativity. In contrast, the way that characteristics of creative products (e.g. originality) are perceived appears more complex. This research sheds additional light on long-standing debates regarding domain-generality/specificity and creativity.

### **The outcome of the research:**

In line with previous research, the results of this study indicate clear differences at the level of General Thematic Areas (GTA). Art students are different from science students in terms of personality. Broadly speaking, Art students are more open to new experiences, more agreeable (see also Feist, 1998), and have a higher Creative Self-Efficacy (CSE: see also Furnham, Batey, Booth, Patel, & Lozinskaya, 2011) than their science counterparts. Importantly, however, effect sizes in the present study suggest that these differences, while statistically significant, are small. As with Person, hypothesized differences in Divergent Thinking (DT) - the core cognitive process associated with creativity - were found between the GTA under investigation. Art students, in this case, showed statistically significant, higher levels of fluency, both in general and for function-first problems. However, as was the case for openness and CSE (i.e. Person factors), these differences remain small as determined by effect size. In addition to differences in Person and Process, this study explored differences in how individuals perceive the qualities of a creative product across GTA, domains, and micro-domains. Specifically, the degree to which individuals associate a product's originality, feasibility, and effectiveness with creativity were examined. Consistent with the findings for Person and Process, there is little practical difference in the way art and science students perceive product creativity or associate key product qualities with creativity. Both, it can be said, see originality as central to defining the creativity of a product, with effectiveness also moderately important.

## **Creative Idea Forecasting: The Effect of Task Exposure on Idea Evaluation**

History is replete with cases in which people have failed to recognize creative ideas generated by others. In various settings, people are responsible for evaluating ideas generated by others while not being involved in the idea generation process, and thus not exposed to the task. However, little is known on how this lack of task exposure affects creative forecasting. This study therefore examines the effect of task exposure on creative idea evaluation using 1864 German students who evaluated ideas on their creativity, originality and feasibility. Their ratings were compared to ratings by content and creativity experts. The students were randomly assigned to 1 of the following conditions: task exposure (i.e., they had to generate and evaluate ideas for the same task) or no task exposure (i.e., they had to generate ideas for a different task than the idea evaluation task). The results show that task exposure improves students' ability to accurately recognize creative and original ideas, and their ability to discriminate between highly feasible and unfeasible ideas. As such, these findings suggest that task exposure is beneficial to creative idea forecasting. Together, the results highlight the importance of carefully reconsidering whether people should be exposed to a task before evaluating others' ideas.

### **The outcome of the research:**

The results show that task exposure improves students' ability to accurately recognize creative and original ideas, and their ability to discriminate between highly feasible and unfeasible ideas. As such, these findings suggest that task exposure is beneficial to creative idea forecasting. Together, the results highlight the importance of carefully reconsidering whether people should be exposed to a task before evaluating others' ideas.



## **Instructing children to construct ideas into products alters children's creative idea selection in a randomized field experiment**

Many popular pedagogical approaches instruct children to construct their ideas into tangible and physical products. With the prospect of implementation, do children decide to go for the most creative ideas or do they shift towards ideas that are perhaps less creative but easier to construct? We conducted a field experiment to test whether expected construction affects children's creative idea selection. In this experiment, 403 children were asked to select the most original ideas to make a toy elephant more fun to play with. We randomly assigned them to a treatment condition—in which they were informed they had to construct one of the original ideas that they selected—and a control group—in which children were informed that, after idea selection, they had to perform another task. Children who were instructed to construct the selected idea into a tangible product turned a blind eye to original ideas and preferred the more feasible ideas. Thus, pedagogical approaches that aim to stimulate creativity by instructing children to construct original ideas into tangible and physical products may unintentionally change children's choices for creative ideas. This finding highlights the importance for educators of guiding children's decision-making process in creative problem solving, and to be aware of children's bias against original ideas when designing creative assignments for them.

### **The outcome of the research:**

Children who were instructed to construct the selected idea into a tangible product turned a blind eye to original ideas and preferred the more feasible ideas. Thus, pedagogical approaches that aim to stimulate creativity by instructing children to construct original ideas into tangible and physical products may unintentionally change children's choices for creative ideas. This finding highlights the importance for educators of guiding children's decision-making process in creative problem-solving, and being aware of children's bias against original ideas when designing creative assignments for them.

## **Teaching and learning for creativity in science and mathematics**

Scientific and mathematical creativity are important to support innovation in the 21st century. These creative skills can be taught and learned at school. In this chapter, we present important theoretical frameworks that help us understand how they can be developed in the classroom. We cover some of the challenges and opportunities that come with it and present some design principles and practical applications for primary and secondary classrooms. We then address the latest research trends in emerging and propose future lines of research in this space, including the role of technology in the measurement and development of scientific and mathematical creativity, and the increasing use of dynamic micro-longitudinal approaches to studying them.

### **The outcome of the research:**

We present important theoretical frameworks that help us understand how they can be developed in the classroom. We cover some of the challenges and opportunities that come with it and present some design principles and practical applications for primary and secondary classroom.

## **The Evaluation and Selection of Creative Ideas in Educational Settings: Current Knowledge and Future Directions.**

Worldwide, student-centered pedagogies have emerged in education to develop creativity. However, these pedagogies do not automatically enhance students' creativity, because students tend to underestimate and reject creative ideas – even when highly novel ideas are required to solve the problem at hand. Understanding how students evaluate and select ideas is crucial for enhancing creativity. Therefore, this paper reviews research on idea evaluation and idea selection among students. This paper suggests that the evaluation of ideas depends both on specific and general components, and a mild state of affect and openness to experience seems to play a significant role. To improve idea evaluation and idea selection, students should be exposed to a variety of ideas and effective instructional strategies benefit students as well. Teachers should explicitly instruct students to select creative ideas and encourage them to simultaneously generate and refine ideas. However, instructing students to transform their creative ideas into tangible products may unintentionally influence their choices for creative ideas. Balancing novelty and usefulness pose challenges for students during evaluation and selection, and teachers should attune to students' reactions as much as possible (e.g. accommodating emotional outbursts). Finally, several future trends and important research questions are highlighted.

### **The outcome of the research:**

This paper suggests that the evaluation of ideas depends both on specific and general components, and a mild state of affect and openness to experience seems to play a significant role. To improve idea evaluation and idea selection, students should be exposed to a variety of ideas and effective instructional strategies that benefit students as well. Teachers should explicitly instruct students to select creative ideas and encourage them to simultaneously generate and refine ideas. However, instructing students to transform their creative ideas into tangible products may unintentionally influence their choices for creative ideas. Balancing novelty and usefulness pose challenges for students during evaluation and selection, and teachers should attune to students' reactions as much as possible (e.g. accommodating emotional outbursts).

# Mare VAN HOOIJDONK

## Creative Problem Solving in Primary School students

In this article, two studies are reported that aim to give insight in the nature of creative problem-solving in primary school students.

Focused on the process and aimed to determine to what extent behaviors in response to a task matched the Creative Problem-Solving model (CPS model; Isaksen et al., 2011; Treffinger, 1995). 13 fourth graders participated in Study 1 and were asked to think aloud while completing a structured creative problem-solving task. Their behaviors were coded based on the CPS model. Results showed that the behaviors of the students could be described with the CPS model. All elements were found: understanding the challenge, generating ideas, preparing for action, and planning your approach. The number of utterances within elements and the sequence of the creative problem-solving processes varied across students.

Focused on the product and aimed to determine the relations among creative problem-solving outcomes and the overlap of these outcomes with divergent thinking and academic achievement outcomes.; 594 fourth, fifth, and sixth graders completed similar creative problem tasks for three problem situations. Students' ideas were rated on four CPS indicators. A measurement model and structural model were tested. The results showed that the relations among the creative problem-solving indicators and those with divergent thinking and academic achievement largely corresponded with theory and with relations found in earlier studies.



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### The outcome of the research:

The overall conclusion of the two studies was that the CPS model can be applied in the primary school context and creative problem-solving capability is already evident in primary school students.

Insights into the nature of creative problem-solving in young students and creative problem-solving tasks that can be applied in the classroom.

# Frances WARREN

## The role of implicit theories, age, and gender in the creative performance of children and adults

The aim of this research was to explore the individual differences that might relate to creative thinking, by focusing on the role of implicit theories in creative performance. According to the work of Dweck and colleagues (e.g. Dweck, 1986; Dweck, 1999; Dweck, 2011; Dweck & Leggett, 1988), individuals fall on a continuum according to their beliefs regarding the malleability of personal traits and characteristics, and these beliefs orient them towards different goals, responses, and behavior patterns. While some individuals believe that abilities and attributes are based on innate and unchangeable "entities" (said to endorse an entity theory), others believe that abilities and attributes are relatively malleable and can be developed (holding an incremental theory). Findings from existing research demonstrate that holding an incremental theory of intelligence is associated with higher academic achievement, yet few studies have examined how implicit theories relate to creative performance. Therefore, within this two-study paper, we examined the relationship between implicit theories and performance on a divergent thinking task in a sample of children and adults. Study 1 explores the relationship between implicit theories of intelligence and divergent thinking scores in children aged 4-7 years. Study 2 extends on the findings by investigating adults' implicit theories of creativity and their association with divergent thinking skills.



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### The outcome of the research:

For both children and adults, endorsing a stronger entity theory was associated with lower scores in divergent thinking. Specifically, children who believed that intelligence is a fixed, unchangeable entity scored lower on the divergent thinking task. Accordingly, for adults, those who endorsed a stronger entity theory of creativity scored lower on the divergent thinking measure.

# Filipe ZAMANA

## **The Future of Education as a Creative Ecosystem: A Sociocultural Framework for the Development of Creativity**

This article explores the social and educational impact post COVID-19 on education through the perspective of creativity. This is a reflective and forward-thinking piece of how creativity can transform the future of education. The article is structured into five parts. First, the opportunities and barriers that COVID-19 offers in preparing students for an uncertain future. Second, the recognition of the vital role of creativity in the future. Third, the article discusses the value of creativity in education. Fourth, the teachers' role in stimulating creativity and how its practices can be encountered in 21st-century education is commented on. Fifth, the last section presents perspectives for the future of education in an uncertain and complex world, introduces the concept of creative ecosystems for education, and summarizes the key points related to the aspects to which education should devote its efforts in the coming years.



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### **The outcome of the research:**

The article questions if more creativity-focused education is possible in the future and promotes a deep reflection in this context for teachers and educational institutions about the topics that need more attention during this time of change.

# Dimitrios ZBAINOS

## Developing Student Creative Potential: Towards a Didactic of Creativity

Creativity is a multifaceted phenomenon, a dynamic interplay between individual potential and the enriching environment of interaction and experience. Building on this fact, our research aims to propose a comprehensive model of didactics for creativity, to foster student creative potential within educational settings through the following steps:

While traditional assessments provide valuable points, they have limitation to capture this dynamic quality. Dynamic Assessment (DA) emerges as a powerful tool, shifting the focus from static measurement to actively fostering student creative potential. Dynamic Assessment, grounded in Vygotsky's sociocultural theory, and in line with the modern sociocultural theorization of creativity includes a pre-test, a mediational intervention, and a post-test within the testing situation resembling real-world social interaction, where learning and development occur through guided exploration and the internalization of mediated strategies. Our findings so far with primary school children have demonstrated that DA provides not only "ability" scores but also "development potential" scores that can be used in the educational process.

To optimize learning outcomes for all students in today's diverse classrooms, differentiated instruction that addresses individual needs and developmental potential for creativity is essential. Our research investigated grouping students based not only on "creative ability," but also on their "developmental potential for creativity." By employing cluster analysis on data obtained from dynamic assessment, we made a few efforts to identify diverse student groups with distinct needs, allowing educators to tailor instruction accordingly.

We have investigated the effectiveness of differentiated instruction in fostering creativity among third-grade students. Sixty-one students participated in the study, divided into three groups. The Differentiated Intervention Group (DIG) received instruction tailored to their individual needs based on a creativity assessment. The Ordinary Intervention Group (OIG) performed the same activities as the DIG group, but without any specific instruction focused on creativity. Finally, the Control Group (CG) did not receive any intervention. Before and after the intervention period, all students were assessed for both verbal creativity (using the EPoC test) and creative writing through Consensual Assessment Technique (CAT). The results revealed that both the DIG and OIG groups improved in verbal creativity compared to the control group. However, only the DIG group, which received differentiated instruction, showed a significant improvement in their creative writing as judged by experts. This suggests that while both methods stimulated creative thinking, differentiated instruction proved more effective in helping students translate their creative ideas into real world products.



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### The outcome of the research:

These findings highlight the potential of differentiated instruction based on grouping students according to DA as a powerful tool for cultivating creativity in students. When instruction and activities are tailored to meet individual student needs and abilities, it appears to significantly benefit their creative development. Further research with larger samples and across different grade levels is recommended to solidify these findings and explore the long-term impact of this approach and contribute to a comprehensive Didactic of Creativity.



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