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# This is My Fairy Tale: How Emotional Intelligence Interacts with a Training Intervention in Enhancing Children's Creative Potential

## ABSTRACT

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 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 was 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.

*Keywords:* creative potential, training, emotional intelligence, children.

Creativity is recognized as one of the most important features for the progress of the human species (Corazza, 2017; Glaveanu et al., 2020; Kozbelt, 2019; Puccio, 2017). Reports from international organizations devoted to the analysis of future world governance pose creativity at the top of the skills needed for the future of human work (e.g., World Economic Forum, 2016). The potential ability of generating novel and effective ideas is, indeed, acknowledged as key in contemporary and future societies (Glaveanu et al., 2020). It is, therefore, not surprising that education is paying more and more attention to the development of creative abilities starting from preschool age (e.g., Gralewski, Lebuda, Gajda, Jankowska, & Wiśniewska, 2016; Torrance, 1981).

Creative potential, in particular, is a central topic in the realm of education and development. This concept concerns the latent ability to produce original and adaptive work, which is a core feature of the human mind (Barbot, Besançon, & Lubart, 2015; Corazza & Glăveanu, 2020; Walberg, 1988). Creative potential should not be considered as a unidimensional construct; rather, it has been described as a multifaceted and —partly—domain-specific set of resources (Barbot et al., 2015). It is multidimensional since a creative act requires different resources belonging to diverse personal and environmental dimensions, while it is domain-specific since the combination of these different resources can depend on the specific knowledge domain. Aspects of motivation, emotional resources, personality dimensions, cognitive abilities, as well as biological factors interact in the expression of creative potential. In particular, creativity researchers extensively explored the cognitive resources defining creative potential by focusing on cognitive processes and abilities sustaining the creative thinking process (see Benedek & Fink, 2019). However, research also demonstrated that cognitive resources are largely intertwined with the other dimensions defining creative potential, especially with emotional components (Baas, De Dreu, & Nijstad, 2008). Emotions can, indeed, drive the creative thinking process (Agnoli & Corazza, 2019) and they strongly influence creative cognition (Baas et al., 2008). Past research revealed that brain structures related to emotional processing are associated with trait creativity already in primary school children, showing how emotions are essential elements for the development of creativity (Xia et al., 2017). Children with high trait creativity showed, for example, higher risk taking and challenging behavior, mediated by amygdala and hippocampus, in association with creativity tasks.

The abilities in using and managing the emotional resources during the process have been highlighted as fundamental components for the creative success (Ivcevic & Hoffmann, 2017). Trait emotional intelligence (trait EI), in particular, emerged to be fundamental for achievement in a creative process. Trait EI is defined as an ensemble of emotion-related dispositions and self-perceptions, which are measured *via* self-report instruments (Petrides, Pita, & Konakki, 2007). Research showed that individuals varying in trait EI can differ in the way they process, use, and manage emotional information (Petrides & Furnham, 2003). The trait model conceptualizes EI as a collection of affect-related personality traits measurable with self-reports (Hughes & Evans, 2018; Petrides et al., 2007). The Trait Emotional Intelligence Questionnaire (TEIQue), in particular, has proven to be a reliable measure for this construct (for a meta-analysis see Andrei, Siegling, Aloe, Baldaro, & Petrides, 2016). With the use of this questionnaire, several studies showed that the trait EI model has good discriminant validity in relation to personality by being independently located in both Eysenck's and five factor spaces (Petrides et al., 2007). In addition, research has consistently demonstrated the incremental validity of trait EI over personality-related traits and constructs in relation to criteria such as happiness (Chamorro-Premuzic, Bennett, & Furnham, 2007; Furnham & Petrides, 2003; Gardner & Qualter, 2010), well-being (Singh & Woods, 2008), life satisfaction (Freudenthaler et al., 2008), or sensitivity to stress induction and mood changes (Mikolajczak, Nelis, Hansenne, & Quoidbach, 2008). Moreover, behavioral–genetic research has provided further evidence for the conceptualization of trait EI as an independent personality trait. In particular, a study on mixed dizygotic and monozygotic twins showed that all of the phenotypic associations between trait EI and the big five factors can be attributable, primarily, to correlated genetic factors and, secondarily, to correlated non-shared environmental factors (Vernon, Villani, Schermer, & Petrides, 2008). Even if much must still be understood, trait EI emerged to be important also in young people because of its potential role in several real-life domains for both children (e.g., Mavroveli & Sánchez-Ruiz, 2011; Russo et al., 2012) and adolescents (e.g., Andrei, Mancini, Mazzoni, Russo, & Baldaro, 2015; Frederickson, Petrides, & Simmonds, 2012; Mavroveli, Petrides, Rieffe, & Bakker, 2007). Individual differences in trait EI emerged to be relevant for positive adaptation within the classroom, being particularly important for children's social–emotional competences and consequent adaptive behaviors with peers (Frederickson et al., 2012). More importantly for the purpose of the present work, emotional intelligence emerged to be a central element of the creative thinking process both in adults (Agnoli & Corazza, 2019; Agnoli, Franchin, Rubaltelli, & Corazza, 2019; Lubart & Getz, 1997; Zenasni & Lubart, 2008) and in children (Hoffmann, Ivcevic, & Maliakkal, 2020) by managing the emotional resources which are core elements of the creative potential and, thus, leading to creative success or, in the case it is present only at low levels, to creative inconclusiveness that is to the impossibility to generate ideas that possess the requirements of originality and effectiveness (Agnoli et al., 2019; Corazza, 2016).

Drawing on the investment theory by Sternberg and Lubart (1991), in order to use the different resources constituting creative potential in an effective modality, they must converge in a way that "capitalizes upon them both singly and in interaction" (p. 5). The resources defining creative potential must, thus, be viewed in interaction and not in isolation. The integration of creative potential resources as well as the maturation of the single resource are strongly subject to developmental forces depending on biological factors, family and educational environments, and the so-called Zeitgeist (Simonton, 1987, 1988), as well as the presence of eminent creative role models (Simonton, 1975). The main aim of the present work is to test an interaction hypothesis within this confluent framework. Specifically, we were interested in understanding whether the increase in specific cognitive resources defining the creative potential during childhood, as induced through a newly developed training intervention based on the generation of fairy tales, could be moderated by another dimension constituting children's creative potential, that is, their emotional resources and, in particular, their trait emotional intelligence.

## THE DEVELOPMENT OF CREATIVE POTENTIAL

The reasons behind changes in creative potential and the developmental trajectories followed by creative abilities have long been debated in creativity research (Barbot, Lubart, & Besançon, 2016; Charles & Runco, 2001; Claxton, Pannells, & Rhoads, 2005; Gralewski et al., 2016; Kim, 2011; Torrance, 1968). A general consensus is emerging regarding the non-linear nature of the development of creative abilities from early childhood to adulthood (Barbot et al., 2016; Gralewski et al., 2016). Research showed several "slumps and peaks" during the development of creativity, which are moments of regress (slumps) and progress (peaks) in creative abilities. However, no universal agreement exists on the number, occurrence, and length of these fluctuations (e.g., Barbot et al., 2016; Charles & Runco, 2001; Claxton et al., 2005; Gralewski et al., 2016; Kim, 2011). This lack of consensus may be imputed to the different trajectories characterizing different creative abilities that do not follow identical development patterns (Barbot et al., 2016). Kim (2011) showed, for instance, that fluency in producing alternative ideas in divergent thinking (DT) increases from kindergarten to grade 3 (from age 5 to age 8), it stabilizes at grade 3–5 (ages 8–10), and then decreases after grade 5 (age 10) till adulthood. The ability to produce original contents, instead, seems to grow linearly from kindergarten to grade 5 (from age 5 to age 10), then decreases with a slump in the secondary school, and increases again during adulthood (Kim, 2011).

Creative potential emerges, therefore, as a dynamic entity, with a set of resources that can evolve over time through natural and cultural—as well as environmental—embedded situations (Besançon, Lubart, & Barbot, 2013). When it comes to the exploration of the cognitive resources defining creative potential, the creative cognition approach, which places creativity into normal cognition, highlighted that creative thinking involves basic cognitive processes, such as executive functions, working memory, and inhibitory control (Benedek & Fink, 2019; De Dreu, Baas, & Nijstad, 2008; Nijstad, De Dreu, Rietzschel, & Baas, 2010). These cognitive processes can be highly subject to changes due to developmental variations as well as specific training. One of the most important environments for the fostering and structuring of human creative potential is school, being the learning environment *par excellence*. The effect of the school environment has been explored in a number of studies. In a review by Davies et al. (2013), the authors summarized a series of characteristics of the school environment that can foster creative abilities in children, including physical environment, availability of resources and/or materials, pedagogical environment, play-based learning, and relationships between teachers and students. While the authors described the optimal conditions to promote creativity in school, they also highlighted that the school environment is often far from being an optimal context. In particular, past research suggests that part of children's creative potential gets lost during development or becomes crystallized within individual talents of personality tendencies, and this loss can be precisely imputed to the academic environment, which seems not to be able to exploit the student's creative potential (Agnoli, Runco, Kirsch, & Corazza, 2018; Runco, Acar, & Cayirdag, 2017).

## CREATIVITY TRAINING INTERVENTIONS

In order to counteract this loss in creative potential due to natural developmental trajectories and cultural and environmental factors, several training interventions aimed at teaching or training creative abilities have been developed and tested in the scientific literature (Scott, Leritz, & Mumford, 2004a, 2004b). The aim of these interventions is, using Torrance (1987) words, to "equip children with the skills of creative thinking and with the motivations to continue thinking creatively throughout their lives" (p. 190). In other terms, their purpose is to provide children with specific disciplined methods to take control over their creative potential. More than one hundred intervention studies on school-aged children are present in the scientific literature (Ritter & Mostern, 2017). Meta-analytic reviews conducted on this vast literature (Scott, Leritz, & Mumford, 2004a, 2004b; Tsai, 2013) demonstrated that creativity training is, indeed, effective in increasing creative abilities, especially when focused on the complex creative thinking process and not only on idea generation, or when it is centered on training cognitive abilities specifically related to creative cognition (Scott et al., 2004a). Even if a creative training intervention is not able to act on the entire set of constituents of the creative potential, trainings can focus effectively on subsets of abilities or experiences that may enhance creative thinking. Scott et al. (2004a), in particular, classified the training interventions on the basis of the cognitive processes targeted in the training, training techniques, media used for the training, and exercises provided in the training. Most of the trainings are centered on idea generation, this process being the core phase in the complex creative process; but cognitive processes at the basis of idea generation are not the only elements of a creative process, and thus other training interventions have also focused on problem finding, conceptual combination, idea evaluation, etc. The types of processes are trained in different interventions through various techniques, such as computer-based instructions or frontal lectures. The last element of distinction between interventions is the practice exercises that are used during training, employing, for example, small-group activities or individual exercises.

In summary, the educational and psychological literature shows a consistent attempt to develop disciplined interventions to increase or intervene on children's creative potential. All these interventions share the common feature to propose a disciplined approach to creative thinking and creative cognition in particular, providing the children with a meta-cognitive and awareness of knowledge of their creative abilities, to allow them to take control over their creative potential. However, previous research did not explore how the training of children's cognitive abilities can interact with the other constitutional elements of creative potential, and in particular with children's tendencies in emotional intelligence, which emerged as central in the management of the creative process. This is, indeed, still an unresolved question that would be worth to be explored.

## THE CURRENT WORK

In the current study, we explored the efficacy of a newly developed training intervention in increasing the creative potential in children from grade 3 to grade 5. The new training, tagged as Creative Thinking Training for Children (CTT-C), is focused on the invention of fairy tales. It foresees a short intervention based on four sessions, for a total duration of one month, aimed at exercising children's cognitive abilities related to the generation and evaluation of creative products as well as children's understanding of the meaning and use of their cognitive abilities, that is, their meta-cognitive abilities and awareness. Specifically, this training intervention was developed drawing on the previous research highlighting the elements increasing the efficacy of a training program devoted to creativity (Scott et al., 2004a, 2004b). In particular, the training was centered on different processes constituting the creative process, and particularly on idea generation and idea evaluation. We decided to focus on these two specific creative processes because of the extensive indications in the literature regarding the training of idea generation and idea evaluation, which serve as a theoretical and methodological background to develop the new training intervention. Moreover, restricting the training to these two central processes of the creative process allowed one to develop a relatively short intervention, which might be further improved in the future with other training modules (for example, exercising problem finding or idea implementation). Specifically, following Scott et al. (2004a, 2004b), we stimulated several cognitive abilities related to creative thinking (e.g., fluency, flexibility, originality production), as well as children's meta-cognitive understanding of their abilities and processes. In addition, a mixed modality was adopted in the techniques used to train children's creative potential, joining frontal lectures and computer-based instructions, as well as in the practice exercises used during the training, combining small-group activities, and individual exercises. We were particularly interested in exploring whether this intervention could influence the creative potential during the last grades of primary school.

Creative potential was here measured in an experimentally controlled setting (i.e., training group *vs.* control group) through the Evaluation of Creative Potential instrument (EPoC, Lubart et al., 2011), which takes into account different processes characterizing children's creative potential. Specifically, according to this evaluation method, the microprocesses defining creative potential can be classified around two main thinking modalities: the divergent modality, identifying the explorative process leading to the generation of many alternative ideas, and the integrative modality, leading to the synthetic integration of many information elements to generate original ideas. Changes in these two modalities were measured across grades and experimental conditions.

However, since creative potential is a multifaceted construct, and cognitive/meta-cognitive abilities are only some of the many dimensions defining it, as previously stated, we were interested in understanding whether the efficacy of our training intervention could be affected by the level in another constitutional element of children's creative potential, which was not been directly exerted during the training protocol, that is, the emotional dimension. Therefore, on the one side, we trained children's creative cognition and meta-cognition, and on the other hand, we measured their tendencies in emotional abilities, that is, their trait emotional intelligence. Through the formulation of an interaction hypothesis, it is possible that the empowerment of an element of the creative potential (i.e., the cognitive component) could be affected by the level of another component of the potential (i.e., the management of the emotional component). Specifically, as a first hypothesis, we expected an overall increase in creative potential in the training group, as compared to the control group. As a second hypothesis, we expected that the efficacy of the new training intervention could be modulated (i.e., moderated) by the level of the trait emotional intelligence of the children since creativity involves the use of emotional resources whose management could emerge as essential during the execution of the training by children.

# METHOD

## PARTICIPANTS

Four hundred and forty-eight children were involved in the study. All participants were recruited from primary (third- to fifth-grade) state schools in three medium-sized cities in the North of Italy. Specifically, two groups of participants have been involved in the study: a training group, which was included in the short training program, and a control group, which was not involved in the training intervention. Both groups completed a pre- and a post-test measurement. The recruitment was specifically performed to balance the number of participants in the two groups; to this purpose, six classes for each school were involved in the study, with three classes (one per each grade, 3rd, 4th, 5th grade) randomly assigned to the training group and three classes to the control group (see Table 1).

Children who did not participate to either the pre-test or the post-test measurement ($n$ = 38) were excluded from the analyses. Complete data were, therefore, available for 410 pupils (202 females; age range = 8–11 years; mean age = 9.28 years; $SD$ = 10 months). The present research conformed to the Declaration of Helsinki and was approved by the Bioethics Committee of the University of Bologna. Parents provided their written consent for the study, and children were freely allowed to participate in or abstain at any time from the research.

## INSTRUMENTS

Before and after the training intervention, a specific measurement session was included (pre-test session, post-test session), which was identical for the training group and for the control group. During the pre-test session, both creative potential (EPoC, set A) and trait EI (TEIQue-CSF) were measured, whereas in the post-test session only creative potential (EpoC, set B) was measured (see Figure 1).

### Creative potential: evaluation of potential creativity (EpoC)

Children's creative abilities defining creative potential were measured through the Evaluation of Potential Creativity (EpoC; Lubart et al., 2011). The EpoC instrument is based on verbal and graphic tasks aimed at measuring two key modalities in the creative cognition during development: explorative divergent thinking and integrative convergent thinking.

In the current study, only the EpoC graphical tasks have been used in both the pre-test and in the post-test session, excluding the EPoC verbal tasks. This allows avoiding any possible effects of verbal proficiency in children with parents with a different mother tongue other than Italian, which could have hampered a possible effect of the training intervention. Moreover, this choice was also driven by the graphical nature of the training intervention, which is mainly based on the drawing by the children of alternative scenarios for a fairy tale. Both the explorative divergent and the integrative convergent thinking modality were assessed

TABLE 1. Composition of the Sample Considered for Analyses

| | Grade | | | Total |
|---|---|---|---|---|
| | 3th | 4th | 5th | |
| School 1 | | | | |
| Training | 21 | 23 | 16 | 60 |
| Control | 22 | 23 | 17 | 62 |
| School 2 | | | | |
| Training | 21 | 21 | 14 | 51 |
| Control | 22 | 23 | 18 | 56 |
| School 3 | | | | |
| Training | 19 | 21 | 21 | 61 |
| Control | 36 | 41 | 43 | 120 |
| Total | 137 | 145 | 128 | 410 |

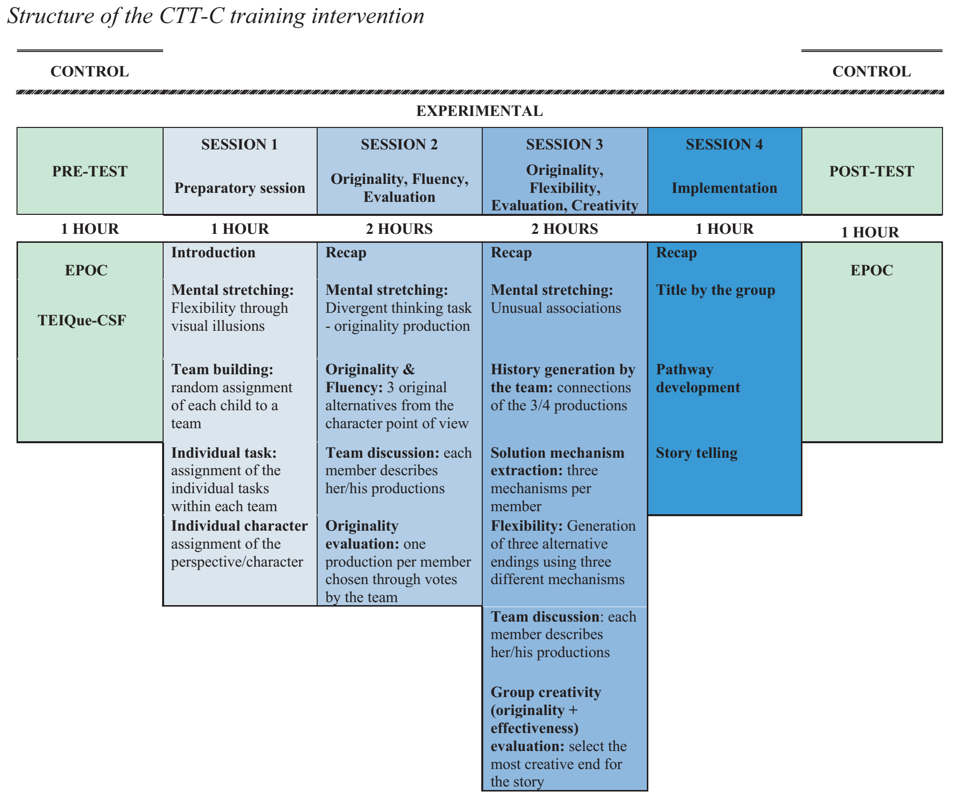


FIGURE 1. Structure of the CTT-C training intervention.

through two types of tasks, which include both abstract stimuli and concrete stimuli. Each child executed the four tasks during a measurement session provided to the class group. Following the EpoC manual, a warm-up trial was first presented to familiarize the children to the type of task required by the instrument. Then, children were asked to perform the abstract divergent-explorative task; specifically, each child was required to produce in 10 minutes as many alternative drawings as they could starting from an abstract stimulus (e.g., a curve line). Then, the abstract convergent-integrative task was presented, asking children to use at least four different abstract stimuli chosen among the eight presented to produce one original drawing in 15 minutes. Specifically, children were asked to try drawing something different from what other children might produce. Then, the concrete divergent-explorative and convergent-integrative tasks followed, which were based on real-concrete stimuli (e.g., a banana). The same timing used for the abstract tasks was maintained in the concrete tasks. The same measurement sequence (i.e., before the abstract tasks and then the concrete tasks) was used in the pre-test and in the post-test measurement session. Since EpoC contains two different sets of stimuli for the four tasks (set A and set B), the pre-test session was based on set A and the post-test session on set B in order to avoid familiarization effects.

The scoring of children's productions was performed by six raters trained in the use of the EpoC instrument. In the divergent-explorative tasks (abstract and concrete), a fluency score was computed, that is, the number of drawings produced by each child starting from the abstract or from the real stimulus. Four separate fluency scores have been, therefore, computed for each child (pre-test abstract, pre-test concrete, post-test abstract, and post-test concrete). Originality scores were instead computed starting from the convergent-integrative tasks. Specifically, following the EpoC scoring manual for originality, the children's integrative ability was scored on a 1–7 score Likert scale, where 1 was assigned to a very poor, free of idea drawing, and 7 to a drawing that contains a high original idea which integrates the elements in an innovative way. The raters were blind to the experimental conditions, and they were randomly assigned a series of drawings that they had to score in terms of originality according to the EpoC manual. Similarly, to the fluency scores, four originality scores have been computed for each child (pre-test abstract, pre-test concrete, post-test abstract, post-test concrete).

### Emotional intelligence: TEIQue-CSF

Trait EI was measured through the Trait Emotional Intelligence Questionnaire—Child Short Form (TEIQue-CSF; Mavroveli, Petrides, Shove, & Whitehead, 2008), which was administered only in the pre-test measurement. This self-report instrument comprises 36 items answered on a 1–5 point Likert scale, whose scores range from 36 to 180. TEIQue-CSF offers a reliable coverage of all aspects of children (aged 8–12 years) trait EI and provides a global score of the child trait emotional intelligence. Consistently with past research (Mavroveli, Petrides, Sangareau, & Furnham, 2009; Mavroveli et al., 2008), TEIQue-CSF showed good internal consistency in the present study ($\alpha = .73$).

## PROCEDURE: THE TRAINING PROTOCOL

The new training protocol, tagged as Creative Thinking Training for Children (CTT-C), is based on the empowerment of children's creative potential through the awareness-raising and the training of specific cognitive abilities subsuming creative thinking. *Fil rouge* of the protocol is the fairytale language. The use of fairy tales has, indeed, shown to be an effective approach for the development of the children's sense of self (Thomas, 1999). Through this language, which is easily accessible to primary school children, explanations and exercises have been included aimed at exercising creative cognition. The final aim for the protocol is the generation of a new creative fairytale.

The CTT-C protocol consists of four training sessions for a total duration of 6 hours (a detailed description of the four sessions has been included in the Appendix S1). A total of six sessions were, therefore, designed, two measurement sessions (pre- and post-test sessions) plus four interim sessions, which were distributed over a 6-week period (one session per week). As shown in Figure 1, the four sessions were meant to exercise specific cognitive abilities such as generative fluency (fluency), generation of original contents (originality), and ability to adopt different points of view (flexibility). Moreover, along with generative abilities, also assessment abilities were trained; specifically, the ability to evaluate ideas originality (both self-generated and other-generated ideas) as well as ideas creativity, taking into account both the originality and the effectiveness of the generated ideas. Through individual and team exercises, these abilities have been repeatedly exerted with the purpose to develop in the child a metacognitive knowledge on the functional mechanisms subsuming creative thinking. Thus, using an educational approach that was structured according to the cognitive and social abilities of primary school students and using both explicit explanations of the creative thinking abilities and practical exercises to employ these abilities, children were guided towards an awareness management of their creative skills.

## DATA ANALYSIS

Since our data (students nested within classes and within schools) were multilevel in nature, multilevel analyses were performed. Given that the purpose of this study was to investigate the changes in creative performance due to the training intervention and the differences in children's trait EI, we focused only in explaining the within-class and within-school variability in the change of performance in divergent (abstract and concrete) and integrative (abstract and concrete) tasks. For this purpose, the variability in each creative performance that occurred between the school and classroom was computed and controlled through the use of Generalized Linear Mixed Models (GLMMs) in SPSS 26.

Since literature suggested that creative abilities show developmental variations in primary school children due to the effect of maturation (Claxton et al., 2005; Gralewski et al., 2016; Kim, 2011), in a first series of preliminary analyses, we examined age variations in the creative performance in the four tasks. For this reason, the differences in performance at the different ages in the four creative tasks during the first measurement session were explored. Children's age was classified into three age groups corresponding to the 3$^{rd}$, 4$^{th}$, and 5$^{th}$ grade (mean age was 8.31 years, 9.27 years, 10.31 years, respectively). Overall performance (without any distinction between training and control group) in the pre-test session was considered for these analyses, performing four GLMM models exploring the effect of GRADE (3 levels) on divergent (abstract and concrete) and integrative (abstract and concrete) abilities.

Moreover, given that we were interested in the variations in the creative performance between the two measurement sessions, an index of the change for each creative measure was derived by computing the difference (delta, Δ) between the post-test performance and the pre-test performance in the divergent and integrative tasks: positive values indicate an increase in creative performance, whereas negative values indicate a decrease in performance. Because our first research question concerned the efficacy of the training intervention in producing a change in creative performance, a series of GLMM models (one per each creative performance index: Δ in abstract divergent ability, Δ in concrete divergent ability, Δ in abstract integrative ability, Δ in concrete integrative ability) were executed, with GRADE (three groups: $3^{rd}$, $4^{th}$, and $5^{th}$ grade), CONDITION (two levels: control condition, training condition), and their interaction (GRADE X CONDITION) as predictors.

Moreover, testing our second hypothesis, in a second series of analyses, we explored whether the children's trait EI level could have interacted with the efficacy of the training intervention. First of all, we explored whether differences in creative performance (in the four indexes) were associated with differences in children's trait EI to understand whether differences in creative potential since the beginning of the training protocol could be related to differences in emotional intelligence. This analysis was performed specifically on the pre-test session indexes using the creative performance in the four indexes as dependent variables and GRADE (three groups: third, fourth and fifth grade), CONDITION (two levels: control condition, training condition), TRAIT EI (including children's trait EI scores as a continuous variable), and the interaction between TRAIT EI and CONDITION as fixed effect. Then, to explore a moderation effect of trait EI on the training efficacy, the changes (Δ) in creative performance in the four indexes were tested not only in relation to the CONDITION (two levels: control condition, training condition), but also in relation to the interaction between TRAIT EI (as a continuous variable) and CONDITION (TRAIT EI x CONDITION). SPSS syntaxes for the tested models are included in the Appendix S2.

## RESULTS

### PRELIMINARY ANALYSES

Descriptive statistics of the performance in the four creative tasks in the pre-test and in the post-test measurements for the two conditions (training and control condition) are shown in Table 2.

The first GLMM model performed in the preliminary analyses showed significant age differences in the divergent thinking performance based on abstract stimuli, $F(2, 404) = 6.087$, $p = .002$. Specifically, as shown in Figure 2a, Bonferroni corrected post hoc comparisons revealed a higher divergent thinking performance based on abstract stimulus at grade 3 than in the following grades, and in particular than at grade 4, $b = 0.657$, $t(404) = 2.818$, $p = .015$, 95% *CI* [0.096, 1.217]. This effect did not emerge instead in the following GLMM model, which did not show any age difference in the divergent thinking ability starting from concrete stimuli ($p = .736$), see Figure 2b. Age differences emerged again in the model exploring grade differences in integrative abilities as measured in the EpoC abstract task, $F(2, 407) = 81.685$, $p < .001$. As

TABLE 2. Descriptive Statistics of the Performance in the Four Creative Tasks for the Training and Control Groups at the Pre-Test and Post-Test Measurement Sessions

| | **Pre-test** | | | | **Post-test** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Min** | **Max** | ***M*** | ***SD*** | **Min** | **Max** | ***M*** | ***SD*** |
| Training condition | | | | | | | | |
| Div. abstract | 1 | 30 | 9.26 | 5.45 | 2 | 63 | 11.54 | 6.59 |
| Div. concrete | 1 | 29 | 8.79 | 5.30 | 2 | 33 | 12.09 | 5.76 |
| Integr. abstract | 1 | 7 | 4.19 | 1.22 | 1 | 23 | 4.83 | 1.95 |
| Integr. concrete | 1 | 7 | 3.29 | 1.19 | 1 | 7 | 3.80 | 1.15 |
| Control condition | | | | | | | | |
| Div. abstract | 1 | 52 | 8.28 | 5.28 | 1 | 33 | 9.18 | 4.83 |
| Div. concrete | 0 | 30 | 7.11 | 4.25 | 2 | 44 | 10.26 | 6.56 |
| Integr. abstract | 1 | 7 | 4.47 | 1.34 | 1 | 7 | 4.72 | 1.31 |
| Integr. concrete | 1 | 7 | 3.87 | 1.33 | 1 | 7 | 3.76 | 1.25 |

*Note.* Div. = Divergent; Integr. = Integrative.

shown in Figure 2c, 3rd grade children showed lower performance (i.e., lower originality scores) in this integrative task than 4th graders ($b = -0.895$, $t(407) = -10.322$, $p < .001$, 95% *CI* [−1.104, −0.687]) and 5th grades ($b = -0.667$, $t(407) = -3.015$, $p = .005$, 95% *CI* [−1.164, −0.169]). No differences emerged between grade 4 and grade 5 ($p = .166$). Finally, similar results emerged in the model exploring age differences in the integrative abilities as measured in the EpoC concrete task, $F(2, 407) = 29.842$, $p < .001$. Again, as shown in Figure 2d, 3rd grade children showed lower originality scores in the integrative task than 4th graders ($b = -0.786$, $t(407) = -6.139$, $p < .001$, 95% *CI* [−1.075, −0.498]) and 5th graders ($b = -0.463$, $t(407) = -6.39$, $p < .001$, 95% *CI* [−0.637, −0.289]). Moreover, 4th grade children showed higher creative performance in this task than 5th grade children, $b = 0.324$, $t(407) = 2.57$, $p = .010$, 95% *CI* [0.077, 0.571].

## EFFICACY OF THE CTT-C TRAINING INTERVENTION

The first model exploring the change (Δ) between the two measurement sessions of the divergent thinking performance based on abstract stimuli as a function of the training intervention and of grade showed a significant effect of the CONDITION, $F(1, 401) = 4.626$, $p = .042$, $b = 0.348$, 95% *CI* [6.199, 0.758], revealing that the training condition was associated with higher increase in divergent thinking in comparison to the control condition. Moreover, a CONDITION X GRADE interaction emerged from this first model, $F(1, 401) = 4.150$, $p = .016$. Specifically, as shown in Figure 3a, where no difference in the change of divergent thinking due to training emerged in 3rd grade children ($b = 0.346$, $t(401) = 0.268$, $p = .789$, 95% *CI* [−2.197, 2.890]), a significant difference emerged in the influence of the condition on the change of the

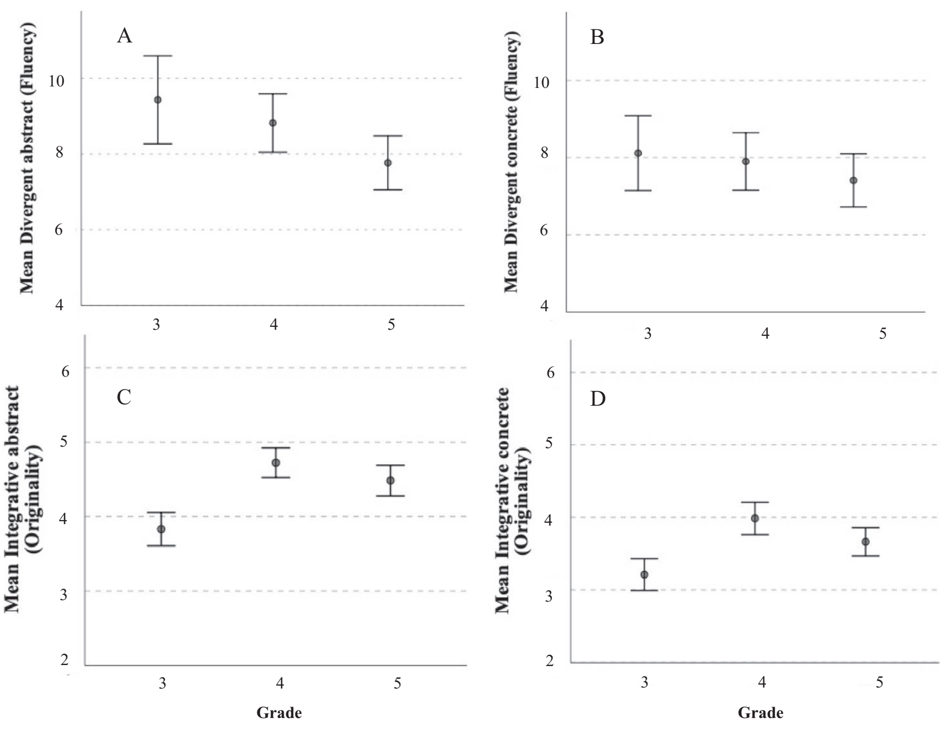


FIGURE 2. Grade differences in the creative performance in the four EpoC tasks in the pre-test measurement.

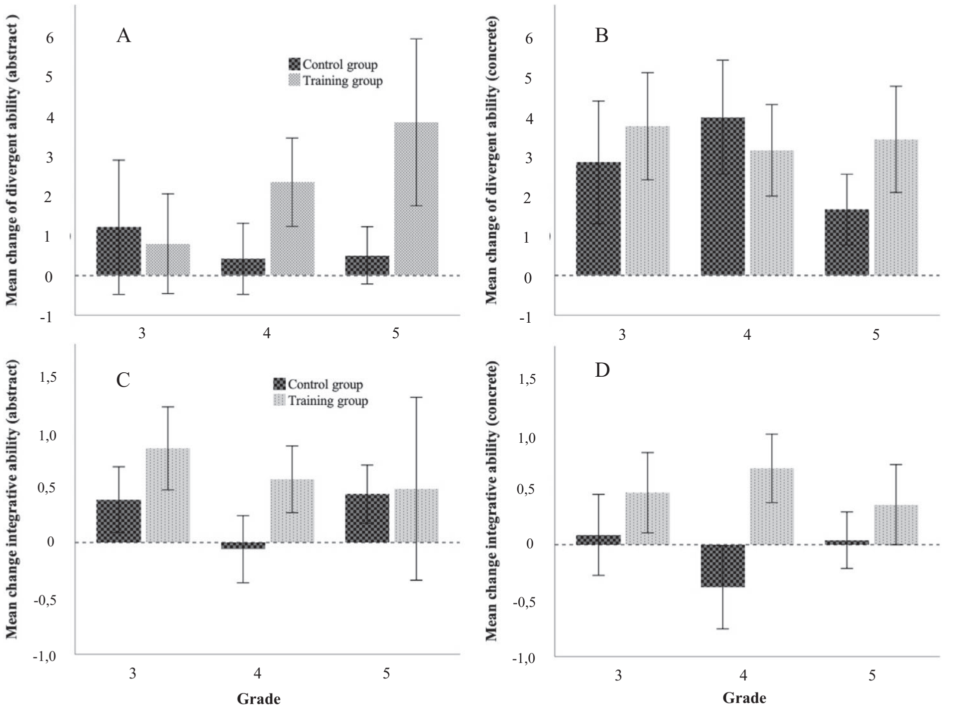


FIGURE 3. Change in the four creative abilities between the post-test and the pre-test measurement sessions as a function of the experimental group (training group, control group) and of the grade group (3rd, 4th, 5th grade). *Note*. Scores above 0 mean an increase in the creativity ability; scores lower than 0 mean a decrease in the ability.

divergent thinking ability based on abstract stimuli at grade 4, $b = -2.074$, $t(401) = -2.937$, $p = .004$, 95% *CI* [−3.462, −0.686], and at grade 5, $b = -3.479$, $t(401) = -2.514$, $p = .012$, 95% *CI* [−6.199, −0.758].

In the second model, the analyses showed a significant effect of GRADE, $F(2, 400) = 62.656$, $p < .001$ and a significant interaction GRADE X CONDITION, $F(2, 400) = 3.364$, $p = .036$ on the change of the divergent thinking ability based on concrete stimuli. This interaction showed that even if no significant difference emerged on concrete divergent thinking between training and control condition at the three grades, the effect of the training was different among the three grades, with an opposite direction of the training condition effect in comparison to the control condition at grade 4, $b = 2.674$, $t(401) = 2.122$, $p = .034$, 95% *CI* [0.196, 5.151] (see Figure 3b), where a higher increase in the divergent ability tended to emerge in the control condition in comparison to the training condition.

The third model on the change of the integrative ability based on abstract stimuli showed a significant effect of GRADE, $F(2, 401) = 5.057$, $p = .007$, and an interaction between GRADE and CONDITION, $F(2, 401) = 3.967$, $p = .020$. Specifically, post hoc analyses revealed, as depicted in Figure 3c, a significant influence of the training condition in comparison to the control condition on the change of the integrative ability based on abstract stimuli in 3rd grade children, $b = -0.434$, $t(401) = -2.578$, $p = .010$, 95% *CI* [−0.764, −0.103], and in 4th grade children, $b = -0.617$, $t(401) = -2.561$, $p = .011$, 95% *CI* [−1.091, −0.143], whereas no difference between the two conditions emerged at 5th grade, $b = -0.049$, $t(401) = -0.101$, $p = .920$, 95% *CI* [−1.003, 0.905].

The fourth model on the change of the integrative ability based on concrete stimuli showed a significant effect of CONDITION, $F(1, 402) = 4.524$, $p = .034$, $b = 0.543$, 95% *CI* [1.140, 0.045], revealing that the training condition was associated with an overall higher increase in divergent thinking in comparison to the control condition. Moreover, the analysis showed a significant interaction between GRADE and

CONDITION, $F(1, 401) = 1768.400$, $p < .001$: whereas no significant difference between the effect of the training and the control condition on the change of the integrative ability emerged at grade 3, $b = -0.366$, $t(402) = -1.229$, $p = .220$, 95% *CI* [−0.951, 0.220], and at grade 5, $b = -0.346$, $t(402) = -1.121$, $p = .263$, 95% *CI* [−0.952, 0.260], a significant effect of the training condition in comparison to the control condition emerged in 4$^{th}$ grade children, $b = -1.066$, $t(401) = -3.706$, $p < .001$, 95% *CI* [−1.632, −0.501] (see Figure 3d).

## ANALYSIS OF ROLE OF TRAIT EI ON TRAINING EFFICACY

As previously mentioned, a first preliminary series of GLM models tested the effect of the trait EI level on the divergent and integrative abilities (concrete or abstract tasks) in the pre-test session. As depicted in Figure 4, no one of these models showed an effect of trait EI or of the interaction between trait EI and the condition on the creative performance measured through the four indexes, showing that no differences emerged in the creative abilities before the training in association with emotional intelligence or of its association with the condition (training or control condition): $F(1, 398) = 1.584$, $p = .209$, $b = 0.038$, $t(398) = 1.117$, $p = .240$, 95% *CI* [−0.025, 0.101] (TRAIT EI x CONDITION: $F(2, 398) = 0.399$, $p = .528$, $b = -0.025$, $t(398) = -0.631$, $p = .528$, 95% *CI* [−0.101, 0.052]) for the abstract divergent task; $F(1, 398) = 0.277$, $p = .599$, $b = -0.007$, $t(398) = -0.230$, $p = .819$, 95% *CI* [−0.069, 0.054] (TRAIT EI x CONDITION: $F(2, 398) = 0.033$, $p = .855$, $b = -0.007$, $t(398) = -0.183$, $p = .855$, 95% *CI* [−0.083, 0.068]) for the concrete divergent task; $F(1, 401) = 2.062$, $p = .152$, $b = -0.002$, $t(401) = -0.365$, $p = .715$, 95% *CI* [−0.013, 0.009] (TRAIT EI x CONDITION: $F(2, 401) = 1.042$, $p = .308$, $b = -0.010$, $t(401) = -1.021$, $p = .308$, 95% *CI* [−0.028, 0.009]) for the abstract convergent task; and $F(1, 401) = 1.408$, $p = .523$, $b = 0.004$, $t(401) = 0.622$, $p = .534$, 95% *CI* [−0.008, 0.015] (TRAIT EI x CONDITION: $F(2, 401) = 2.055$, $p = .153$, $b = -0.013$, $t(401) = -1.433$, $p = .153$, 95% *CI* [−0.030, 0.005]) for the concrete convergent task.

The same results emerged also in the correlation analysis (Table 3), which did not highlight any strong association between trait EI and creative performance in the pre-test session. Only a slight significant negative correlation between trait EI and integrative ability in the abstract task emerged in this analysis, whose significance could be, however, explained by the high number of participants involved in the study. This analysis moreover highlighted how divergent and convergent abilities are nor associated at all. Instead,

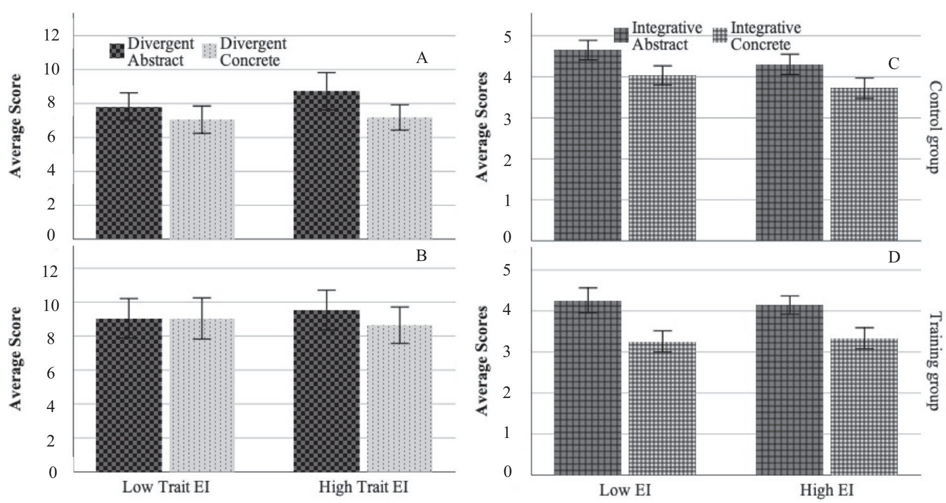


FIGURE 4. Average scores of divergent (panel a and b) and integrative (c and d) abilities in the pretest session for low- and high-trait EI children. *Note*. The graphs in the higher panels (a and c) represent the performance in the control group; the graphs in the lower panels (b and d) represent the performance in the training group. Dark bars represent the performance in abstract tasks; light bars represent the performance in concrete tasks.

performance in the concrete and abstract tasks within each of the two abilities emerged to be significantly associated, highlighting the validity of the two tasks in measuring the same ability.

A second series of analyses explored then the impact or trait EI on the efficacy of the training. A first GLM model tested the influence of trait EI on the effect of the training intervention in inducing a change in the divergent ability starting from abstract stimuli. This analysis did not show any main or interacting effect between TRAIT EI and CONDITION ($p$s > .074).

The second model on the divergent ability based on concrete stimuli showed instead a significant interaction between TRAIT EI and CONDITION, $F(2, 399) = 59{,}105.310$, $p < 0.001$. Specifically, this interaction showed that trait EI had a differential effect on the change of the concrete divergent thinking ability in the control and training group: while higher trait EI level was associated with a significant decrease in the enhancement of the divergent ability in the control group, $b = -0.033$, $t(399) = -35.468$, $p < .001$, 95% *CI* [−0.035, −0.031]; this effect emerged to be not significant in the training group, $b = -0.010$, $t(399) = -0.556$, $p = .579$, 95% *CI* [−0.046, −0.025]. This negative association between trait EI and the increase of fluency in the control group suggests that in the group that did not participate in the training, children at low trait EI levels could have benefitted more from the repetition of the creative tasks than their high trait EI counterparts. This effect did not emerge instead in the training group.

The third model on the integrative ability starting from abstract stimuli showed a significant main effect of CONDITION, $F(1, 400) = 4.982$, $p = .026$, $b = -2.461$, 95% *CI* [−4.628, −0.293], which was further specified by a significant interaction between TRAIT EI and CONDITION, $F(2, 400) = 3.265$, $p = .039$. As shown in Figure 5a, the Johnson–Neyman analysis revealed that the effect of the training condition (i.e., the incremental effect of the training condition in comparison to the control condition on change of the integrative ability) was significant only at low and medium levels of children's trait EI. Specifically, the estimate (slope) of the CONDITION effect was significant ($p < .05$) within the trait EI score interval ranging from 28.40 to 118.23.

Consistent with the previous model, the fourth model on the integrative ability starting from concrete stimuli showed a significant main effect of CONDITION, $F(1, 401) = 70.151$, $p < .001$, $b = -1.968$, 95% *CI* [−2.431, −1.506], and a significant interaction between TRAIT EI and CONDITION, $F(2, 401) = 18.279$, $p < .001$. As depicted in Figure 5b, the Johnson–Neyman analysis again showed that the effect of the training condition was significant only at low and medium levels of children's trait EI. Specifically, the estimate (slope) of the CONDITION effect was significant ($p < .05$) within the trait EI scores interval ranging from 36.06 to 129.84.

In order to integrate the representation of this effect and simplify its visualization, Figure 6 represents the differences in the mean values in the integrative abilities between low (panel a and b) and high (panel c and d) trait EI children (median-spit) in the pre-test and post-test measurements both in the control (panel a and c) and in the training (panel b and d) condition. Again, also raw data seem depicting a higher incremental effect of the training condition (compared to the control condition) on the change of integrative abilities in children with low trait EI, with respect to high EI children.

TABLE 3. Correlations Among Trait EI and Creative Performance Measures

| | **Trait EI** | **Divergent abstract** | **Divergent concrete** | **Integrative abstract** | **Integrative concrete** |
|---|---|---|---|---|---|
| Trait EI | _ | | | | |
| Divergent abstract | 0.089 | _ | | | |
| Divergent concrete | −0.012 | 0.520** | _ | | |
| Integrative abstract | −0.117* | 0.012 | 0.075 | _ | |
| Integrative concrete | −0.069 | −0.009 | 0.098 | 0.464** | _ |

*$p < .05$, **$p < .01$.

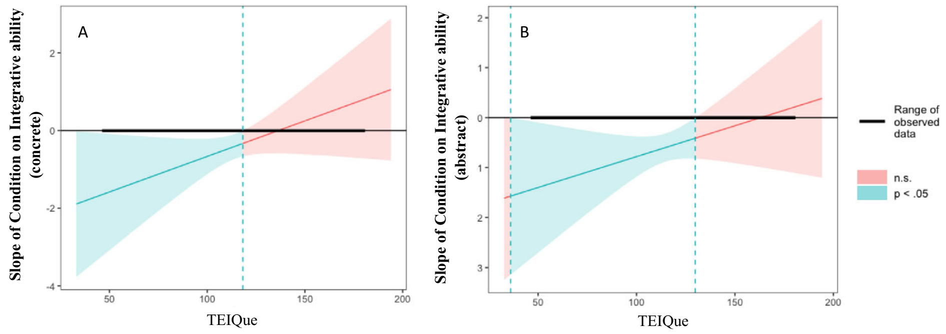


FIGURE 5. The moderator effect of the trait EI level, as measured by the TEIQue scores, on the effect of the training in the Integrative abilities (concrete ability in panel a, abstract ability in panel b). *Note*. Pictures show the results of the Johnson–Neyman analysis revealing that the effect exerted by the training intervention on the training group compared to the control group on the integrative abilities (originality production) was significant only at low and medium levels of children's trait EI. Note that the *y*-axis is the conditional effect of the predictor (condition, i.e., training vs. control) on the predicted variable (change in the integrative ability). The slopes showed where the conditional effect significantly differs from zero. In the two plots, the slope of the difference between the training and the control condition is significantly different from zero from low-to-medium TEIQUE scores. Both slopes are positive, showing (within this range of scores) an incremental effect of the training over the control condition on the change of the integrative abilities.

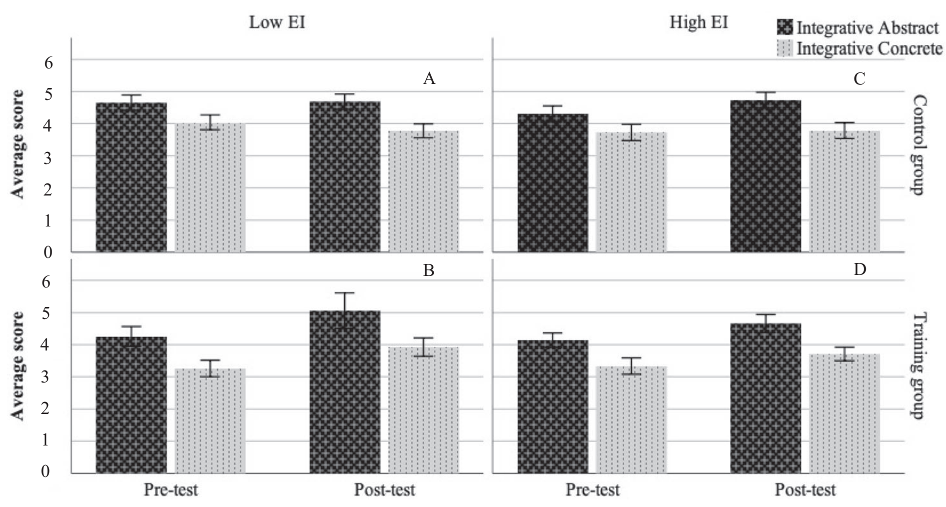


FIGURE 6. The average scores of the integrative abilities in the pre-test session and in in the post test session in low (panel a and b) and high (panel c and d) trait EI children for the control (panel a and c) and in the training (panel b and d) condition.

## DISCUSSION

The present work tested the efficacy of a newly developed fairy tale–based training intervention, the Creative Thinking Training for Children (CTT-C), in increasing the creative potential in primary school children. Moreover, it explored whether the effectiveness of the training in increasing the creative potential could be specified by an interactive effect with children's emotional intelligence. Confirming results of past research (Scott et al., 2004a, 2004b; Tsai, 2013), the findings of the current 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, consistently with Scott et al.' (2004a) reflections, 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, confirming past research, which showed the efficacy of interventions devoted to the training of several processes related to the creative thinking process, 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 in their use.

A first overview on the creative abilities related to the children's creative potential showed a general tendency of the divergent ability to generate multiple contents (i.e., fluency) to decrease from grade three to grade five. On the contrary, a general tendency to increase across grades emerged in our data in the ability to generate original contents. Taking into account that this study is not longitudinal in nature, these findings seem to resemble results from past research showing different developmental trajectories for the various creative abilities underpinning creative thinking (Barbot et al., 2016; Kim, 2011). We cannot, therefore, confirm results showing an overall developmental slump in creativity during grade four (i.e., the 4th grade slump; see Claxton et al., 2005). However, if creativity is operationalized only in terms of the ability of the children to produce multiple ideas (or when creative performance in divergent thinking tasks is not controlled for the confounding effect of fluency; see Forthmann, Szardenings, & Holling, 2020), a decrease in creative performance starting from grade four seems to emerge. However, the data of the present study testify that the decrease in fluency can offer only a partial vision of the more complex creative behavior and of its development. Specifically, our results seem to confirm a general decrease in the quantity of ideas produced by children with age, accompanied by a general increase of the quality of ideas with higher age.

Crucially, our results showed that the training intervention emerged to be effective in increasing children's creative potential especially where it was less present. Even if some differences emerged when creative potential was measured with concrete or with abstract stimuli, the training resulted to be particularly effective in increasing divergent fluency in grade four and grade five children, when thus fluency showed a tendency to decrease in comparison to the previous grade. It was, on the contrary, not effective at grade three, that is, when fluency showed the highest level. In the same vein, the intervention emerged to be effective in increasing the ability to integrate elements in an originality modality (i.e., the ability to generate original contents through integration) at the youngest ages, at grade three and grade four, that is, when this creative ability showed lower scores. No effect of the training emerged instead at grade five, when this ability was higher than the previous grades at the baseline. In summary, the CTT-C training intervention has proved to be specific in its efficacy, increasing creative potential when a shortage in specific creative abilities appears to exist.

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. In the data of the concrete divergent task, instead, emerged an effect that does not seem to be related to the efficacy of the training intervention, in particular a negative association between trait EI and the increase of fluency only in the control group; this result seems suggesting that in the group that did not participate in the training, children with the lowest trait EI levels could have benefitted more from the repetition of the creative tasks than high trait EI children, an effect that is worth further exploration to be properly understood. The effect emerging in the integrative ability again highlighted the multidimensionality of creative thinking and it is in line with the creativity assessment and scoring methods that emphasize the importance of using subjective scoring that dissociates originality from ideational fluency (Silvia et al., 2008). As per the integrative ability, results highlighted that a training intervention devoted to the increment of the cognitive and metacognitive components of children's creative potential could be more beneficial for children characterized by low trait EI levels. The moderation analyses showed, indeed, that the training was effective in increasing the ability to generate original contents in children with low and medium trait EI levels. These results testify how emotions should be intended as integral parts of the creative thinking process. They are not only able to influence the creative process (Baas et al., 2008), but they are core elements for the creative thinking process to happen and for achieving in the creative process (Agnoli & Corazza, 2019). Motivational and emotional forces are able to drive the creative process, which is, in turn, a source of a host of emotional reactions (frustration in the front of failures, excitement in front of new, unexpected ideas, elation in front of a creative success; Ivcevic & Brackett, 2015). As highlighted in the introduction, children with high creativity levels showed better management of emotion-driven behaviors, and in particular higher risk taking and challenging behaviors when associated with creativity tasks (Xia et al., 2017). Research showed, indeed, that the management of the emotional forces driving creativity is essential to succeed in a creative process (e.g., Agnoli et al., 2019). In other terms, the management of the emotional forces regulating the creative process could be able to allow the expression of the creative potential. Trait EI, in particular, emerged to be fundamental to the achievement in a creative task by the management of the emotional forces emerging during a creative process, especially when these emotional forces have a negative nature (e.g., frustration; Agnoli et al., 2019). Trait EI deals with the management of the emotional energy emerging during the process, which is essential to resist to frustration or to allow risk-taking behaviors leading to better performance. Since creativity is a risky behavior (it is an "investment", according to Sternberg & Lubart, 1996) paved by continuous frustrations; trait EI seems to emerge as essential to succeed in creativity.

We might assume that the training intervention could have provided a safe environment especially for children characterized by a low trait EI to express unusual, strange, and risky behaviors, which are not usually convenient in an academic context. In other terms, this safe context could have helped low trait EI children to be more confident in their creative abilities, allowing a time and space to use and express their creative abilities without, for instance, social judgment by their peers. Providing children with a cognitive and metacognitive understanding of their creative process could have helped them face the risk of expressing unusual (i.e., original) contents in front of their peers or managing possible failures since these events are integral parts of the process leading to creativity. It is, indeed, worth highlighting that the social environment too represents a fundamental resource for the expression of the creative potential (Corazza & Glăveanu, 2020). It should finally be highlighted that a similar incremental trend emerged also in children characterized by a high trait EI level in the training condition, although it did not emerge as significantly differently from the trend emerging in the control group. All in all, however, we can conclude 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 and tested.

## LIMITATIONS AND FUTURE DEVELOPMENTS

It is finally worth highlighting that the current study has limitations. First, the proposed training intervention is not compared with an active control group, that is, with a group of children performing an alternative comparable training. Only a passive control group has been used in the study, which does not, however, allow to exclude possible confounding effects, for example, a Pygmalion effect. We, therefore, hope that future research will be able to demonstrate the efficacy of the CTT-C training in increasing children's creative potential in comparison with other interventions, which are analogous in length and contents. Second, it is important to highlight that the results emerged in the present study are based on a partial administration of the EPoC instrument, and in particular on the graphical tasks. It would be extremely interesting to explore whether similar effects would also emerge using the verbal tasks of this instrument. Even if the training is mainly based on drawing exercises (i.e., drawing of different alternative parts of a fairy tale), this analysis would be particularly interesting to test the domain-generalizability or domain-specificity of the emerging effects. A further limitation of the proposed training intervention is to cover only a limited number of components within the complex ensemble of elements defining the creative potential. In order to develop a relatively short intervention, we focused, indeed, only on specific cognitive and metacognitive abilities defining ideation and evaluation. However, it would be worth integrating this intervention with other training modules exercising further components of the creative potential, such as problem finding, problem construction, or creative self-beliefs. Moreover, the results related to the developmental changes of the creative potential should be treated with caution because of the cross-sectional nature of the study. Finally, the lack of an age control for the interactive effect of trait EI on the efficacy of the training could be viewed as a limitation of this study. However, since this study tested for the first time the hypothesis of an interaction between trait EI and the efficacy of a training intervention, and because of the lack of consistency in results regarding the developmental trajectories of the creative potential during primary school, we could not *a* *priori* formulate specific hypotheses to be tested regarding precise effects related to grades on the hypothesizes effect of trait EI. Moreover, testing such an interactive effect by grades in our sample of participants would probably result in an overfitting of our models. We, thus, hope that future research would explore in a statistically adequate sample of participants whether the effect related to trait EI emerging in this study is a stable effect across grades or it is an effect related only to specific grades.

In conclusion, we would encourage future research to further explore multiple resources in the analysis and in the training of children's creative potential. It would be especially interesting to develop specific educational interventions based on the training of both cognitive and emotional components defining the creative potential in order to test whether a combined training could prime a summative mechanism leading to higher levels of creative potential than the levels obtained through the training of isolated components.

## CONFLICT OF INTEREST

No conflict of interest exists by the authors.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available at https://osf.io/w62pt/, https://doi.org/10.17605/OSF.IO/W62PT.

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## SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1. Creative thinking Training for Children (CTT-C) protocol.
Appendix S2. SPSS Syntax for multivelvel analyses.