D2.2 Association between creative performance and creative achievement in the Scientific and the Artistic domain

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ABSTRACT	This deliverable describes different creative profiles within specific domains (science, art, and everyday life), defining different potential levels for the creative achievement in the three domains.
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1. Introduction

1.1. Development of the CREAM test battery

The present deliverable will summarize the activity performed during the second period of the CREAM project related to the measurement of creative behaviour, presenting, in particular, the results obtained from the administration of the test battery developed and tested during the first two periods of the project. Deliverable D2.2 represents therefore the natural prosecution of Deliverable D2.1 "Report on the joint use of the creative cognitive tasks", which described the development, the constituting measures, and the reliability analyses of the CREAM test battery. Specifically, on the basis of a substantial extension of the participants' sample, Deliverable D2.2 will present the results on the creative achievement determinants in the scientific and artistic knowledge domains. Moreover, a comparison with a group of professionals coming from the advertising domain (here identified as Creatives) will be presented.

Since it represents a follow-up document of D2.1, Deliverable D2.2 will present a section where a confirmation of the results and trends emerged from the previous analyses on the CREAM test battery will be provided. The CREAM test battery is in particular centred on the measurement of two main states (stages) of the creative thinking process: ideation (convergent and divergent thinking) and assessment. While convergent thinking is usually defined as the thinking modality aimed at finding the right and unique solution, divergent thinking is defined as the thinking modality aimed at producing all possible alternatives. Beside these creative thinking abilities, the battery also includes two measures of creative achievement devoted to the measurement of creative achievement in scientific, artistic, and everyday areas. Finally, since creative thinking is not an isolated phenomenon within human behaviour, the battery includes the measure of two constructs that the literature demonstrated to be highly related to creativity: intelligence and personality. The results described in D2.1 attested a good reliability of the measurement methods adopted within the CREAM test battery. In particular, the analyses were conducted on a total of 191 participants, 109 from the scientific domain, 47 from the artistic domain, and 36 from the creatives domain. Correlational analyses in particular strengthened the evidences on the discriminant and convergent validity of the tasks used to measure the creative abilities and achievement within the battery. The results, for example, confirmed that convergent and divergent tasks are able to measure two distinct constructs independently, i.e., convergent thinking and divergent thinking, respectively. Moreover, data analyses showed that different data trends characterize assessment ability and ideational abilities, highlighting that assessment ability is a clearly distinct ability from ideational abilities, in particular from divergent thinking. Furthermore, general data trends emerged from the associations of convergent and divergent abilities with intelligence and personality: while convergent abilities were mainly related to intelligence, divergent abilities were mainly associated with personality traits and tendencies, in particular with Extraversion and Openness traits, and with higher levels of intrinsic motivation and self-efficacy. Moreover, convergent thinking abilities and divergent thinking abilities were also differently associated with creative achievement in scientific, artistic and everyday areas. Convergent abilities were mainly related to scientific creative achievement, while divergent abilities were mainly related to artistic and everyday creative achievement. At

the same time, intelligence resulted to be more related to scientific creative achievement, while Openness, Extraversion, and intrinsic motivation resulted to be more related to artistic and everyday creative achievement.

Data analyses performed in D2.1, moreover, highlighted differences and similarities between the three explored knowledge domains. Some preliminary results, indeed, were explored in order to understand whether the CREAM test battery was sensitive to differences between different knowledge domains. As for personality traits and tendencies, the participants from the scientific domain and the participants from the artistic domain seemed characterized by similar personality trends. On the contrary, participants from the Engine Group (creatives) seemed to be characterized by differences in personality compared to science students, in particular they showed higher levels of Extraversion, Emotional Stability, and Openness. Differently, art students did not show differences in personality from creative professionals, highlighting that the creative industry domain was characterized by a personality structure that was more similar to the artistic domain than to the scientific domain. Also the results on intelligence highlighted a similar trend, with science students performing better in cognitive tasks than art students and creative professionals. Creative professionals moreover were characterized by a higher level of divergent abilities (fluency in particular) than science and art students, who were characterized by a similar data trend in divergent tasks. In the same way, creative professionals exhibited higher levels of creative achievement in artistic and everyday areas than artistic and scientific domains. As expected, results showed that science students were characterized by higher levels of scientific creative achievement than art students and creative professionals, whereas art students were characterized by higher levels of artistic creative achievement than science students.

Finally, a preliminary exploration seemed to indicate that creative achievement in scientific, artistic, and everyday areas was associated with different creative abilities, personality traits and tendencies, and cognitive abilities (intelligence). Scientific and artistic domains seemed to be characterized by similar structures in personality and divergent thinking abilities (even if scientific domain was characterized by higher convergent thinking abilities and intelligence than artistic domain). However, professionals from the creative industry domain showed higher levels of creative achievement and of creative abilities (both divergent thinking and assessment abilities) than the other two domains, especially with respect to the scientific domain.

Starting from the results obtained through the administration campaign performed during the first period of the project, and on the basis of the data confirming the reliability of the measures included in the CREAM test battery, a second administration campaign has been performed during the second period of the project. In order to accomplish the objectives of Task 2.2 “Creativity criterion-reference data in different knowledge/professional contexts”, specific analyses on the creative achievement in the different knowledge domains involved in the project has been performed to the aim at finding specific predictors of the achievement within different knowledge/professional contexts.

1.2. Main objectives of the deliverable

The first aim of the deliverable D2.2 is to show a preliminary analysis performed on the data collected during the first year of the project aimed at exploring in a single model the

predictors from the ideational state on the scientific and artistic achievement. The purpose of this analysis was to understand whether different variables were able to predict creative achievement in the two domains, as seemed emerging from the correlational trends.

The second aim of this deliverable is to confirm the trends emerged from the first set of analyses. Correlations between measures and reliability of the instruments included in the test battery are therefore explored on the complete sample collected during the two administration campaigns that were performed during the first two years of the project. Moreover, differences in creative abilities, personality, and intelligence between the science, art, and creatives domains will be presented.

On the basis of the data trends emerged from these first analyses, a set of regression models and moderation analyses will be presented aimed at understanding the main predictors of the creative achievement in the three domains. Specific analyses on the scientific creative achievement will be presented on the science sample. In the same way, specific analyses on the artistic creative achievement will be presented on the art sample. Finally, specific predictors of the everyday creative achievement will be described using the participants from the three domains (science students, art students, creatives).

Final aim of Deliverable D2.2 is to present different profiles describing the main predictors of the creative achievement in the scientific, artistic, and everyday activities. This analysis, in particular, will present different profiles at different levels of scientific, artistic, and everyday creative achievement, describing the ensemble of variables defining the creative success within different domains.

2. Executive summary

Deliverable D2.2 represents the natural continuation of Deliverable D2.1 "Report on the joint use of the creative cognitive tasks", which described the development, the constituting measures, and the reliability analyses of the CREAM test battery. Specifically, on the basis of a substantial extension of the participants' sample involved in the multi-sided measurement of creativity developed within the CREAM project, Deliverable D2.2 presents the results about the creative achievement determinants in the scientific and artistic knowledge domains, as foreseen in the planned activity described in Task 2.2. Moreover, a comparison with a group of professionals coming from the advertising domain (here identified as Creatives) is presented.

Starting from the 191 participants involved in the first set of analyses performed at the end of the first period, a second administration campaign has been performed during the second period. A total of 173 participants were involved in the second administration campaign. Totally, the CREAM test battery has been administered, within two administration campaigns, to more than 400 participants. After the cleaning of the data, the final sample used for statistical analyses, which joins the participants from the two administration campaigns, is composed of 322 participants (177 males).

The analyses performed on the data collected during the first two periods of the project aimed in particular at exploring the differences and similarities in creative achievement between different knowledge domains. Specifically, the main purpose of the analysis is to define the main predictors of creative achievement in the scientific and in the artistic domains. To this aim a data collection within these two domains has been performed, administering the CREAM test battery to students from scientific departments and from artistic departments of the University of Bologna. However, since creative achievement cannot be defined considering only the scientific and artistic domains, we included in the analysis a measurement of a general-domain creative achievement: the everyday creative achievement. The two samples of students (126 Science students, 127 Art students) were therefore compared with a group of creative professionals from the Engine Group (69 professionals), in the attempt to understand similarities and differences in the creative achievement in domain-specific (science and art) and in general domain (everyday creativity) contexts.

Different steps of analyses are presented within Deliverable D2.2. First of all, the correlational analyses between the different measurement instruments of the battery are described; the aim of these analyses is to confirm the associations emerged in Deliverable D2.1 between the different abilities and personality trait and tendencies tested within the battery. Following, the differences and similarities between the three knowledge domains are explored, in order to understand the differences between the scientific, the artistic and the advertisement samples as regards personality, intelligence, creative abilities, and creative achievement. The following section identifies the predictors of creative achievement in scientific, artistic, and everyday domains. In particular, we used hierarchical regressions models to identify the main predictors, and mediator analyses, based on the evidences emerged from the previous analyses, to explore any interaction effect between predictors. The final section describes different profiles in order to identify individuals at different levels of creative achievement (low, medium-low, medium-high, and high) in the scientific, artistic, and everyday domain.

In particular, using the creative achievement as a reference measure to define the "optimum" creative potential, Deliverable D2.2 identifies different profiles within each domain (science, art, and everyday life), defining different creative potential levels for the achievement in the three domains. Adopting such an approach, and using the creative achievement as a reference measure, we were therefore able to identify four specific profiles composed by the most important predictors of creative achievement within each domain, defining a low, a medium-low, a medium-high, and a high (optimal) potential for the achievement in the scientific, artistic, and everyday domain. The variables emerged as central in predicting creative achievement in the three knowledge domains have been therefore mapped within four creative achievement levels, defining a low potential profile, a medium-low potential profile, a medium-high potential profile, and a high potential profile. Each profile represents an ensemble of variables, which distribution identifies a specific potential to achieve creativity in the specific domain. The high potential profile identifies in particular the "optimum" potential level for success within a specific domain. Following, three figures profiling, through the use of the main predictors of creative achievement, the creative potential levels within the scientific (Figure 1), artistic (Figure 2), and everyday (Figure 3) domains are presented.

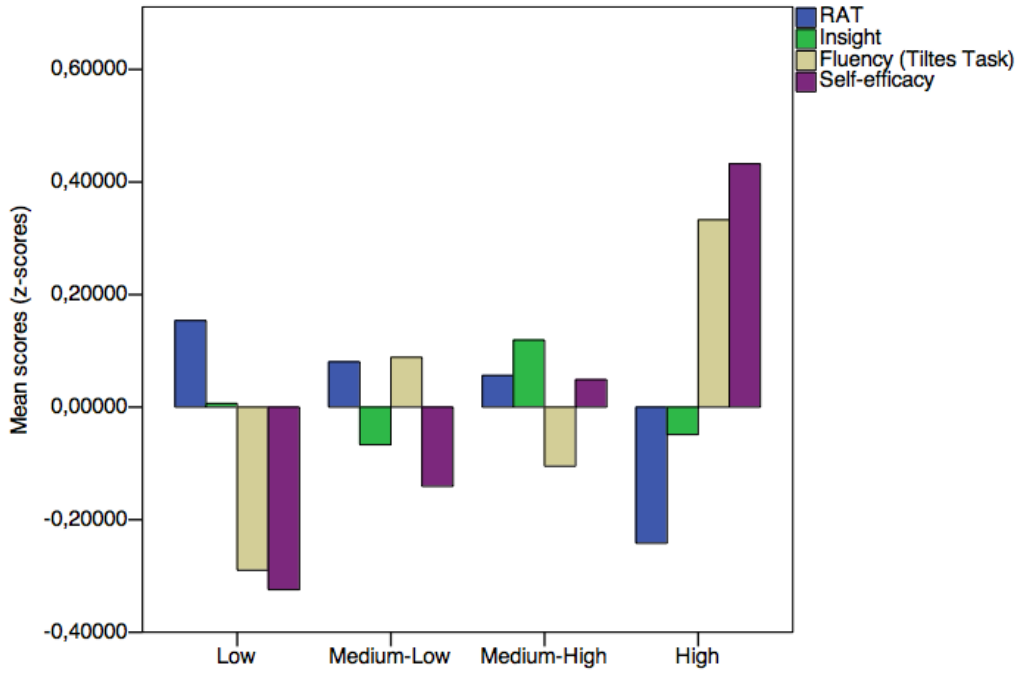

Figure 1. Four profiles composed by the main predictors of scientific creative achievement, defining low, medium-low, medium-high, and high creative potential in the scientific domain.

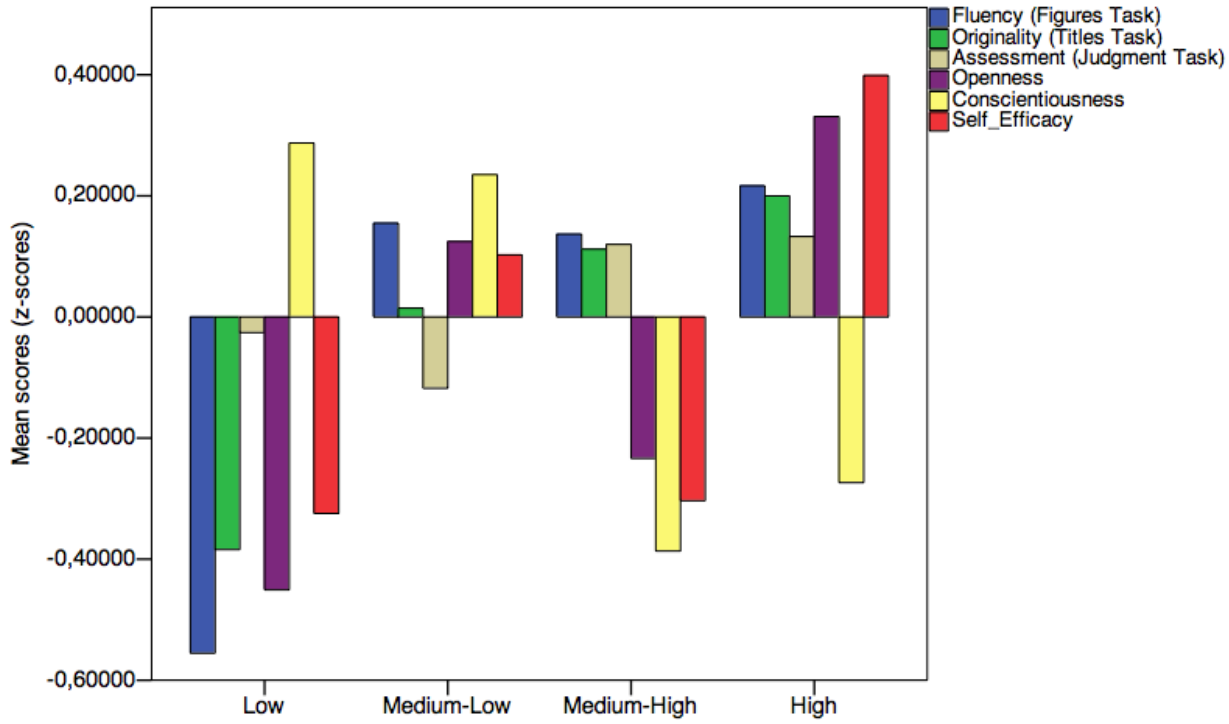

Figure 2. Four profiles composed by the main predictors of artistic creative achievement, defining low, medium-low, medium-high, and high creative potential in the artistic domain.

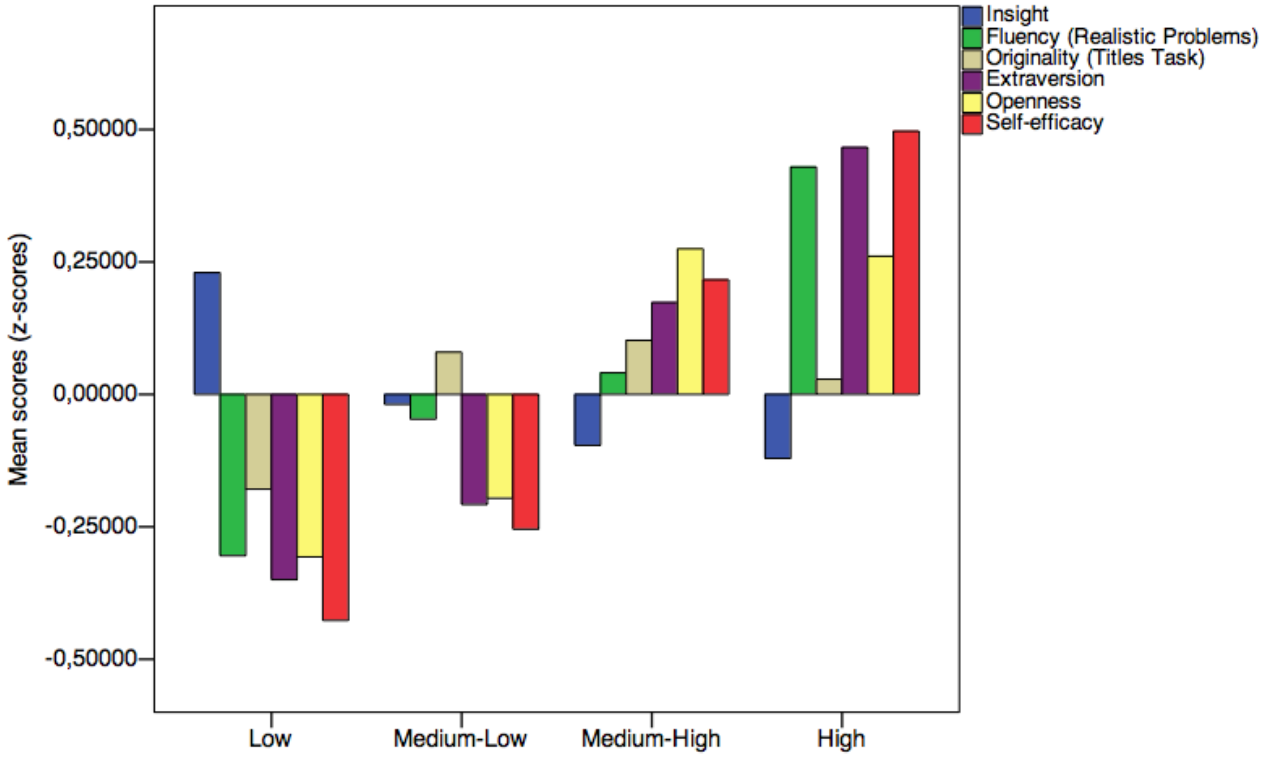

Figure 3. Four profiles composed by the main predictors of everyday creative achievement, defining low, medium-low, medium-high, and high creative potential in the everyday life.

The profiles can be considered as reference-based methodologies (where the reference is the creative achievement within the specific domain) to identify and measure the most important variables predicting creative achievement in the scientific, the artistic, and the everyday domains. Moreover, they can offer useful reference scores for the identification of the individual potential level for succeed in creative activities within the three domains.

3. Preliminary analysis: an ideational model for creative achievement

In the present section we will summarize an analysis performed on the preliminary data collected during the first period of the project. Because of the relatively small number of participants and the type of analysis we intended to use (i.e., structural equation modelling), not all measures defining the CREAM test battery could have been included in the analysis, but we limited our attention to the role of the creative ideational state on the scientific and artistic creative achievement.

The creative process is a dynamic ensemble of cognitive, motivational, attitudinal, and environmental components aimed at the ideation and realization of novel and valuable ideas. A pressing question in the creativity literature is whether these components could assume different relevance in defining creative achievement in diversified domains. In particular, when referring to creativity the golden measure for analyse creative thinking remains divergent thinking, which is defined as the ability to generate multiple associations, following an exploratory nature. Creative thinking, specifically, is used to predict the creative potential, i.e. the extent to which individuals can create novelty (Runco & Jaeger, 2012; Torrance, 1974). Usually, divergent thinking is measured using the criteria of fluency, frequency, flexibility, and originality. The influence of divergent thinking for predicting individual creative achievement has been recently explored using complex factorial models, exploring the interaction of divergent thinking with other constructs as intelligence in the prediction of creative achievement (Jauk, Benedeck, & Neubaumer, 2014; Silvia, 2008).

Starting from the evidences provided by the past literature on the interaction of divergent thinking with intelligence in predicting creative achievement, we integrate the modeling proposed in past research with the multi-sided measurement approach developed within the CREAM project (Agnoli, Corazza, Cagnone, & Runco, 2015). In particular, the aim of this preliminary analysis was to analyse the influences of cognitive and attitudinal components in the definition of scientific and artistic creative achievement in graduate students. In particular, adopting a structural equation modelling approach, we tested whether a unitary ideational model could be applied to predict scientific and artistic creative achievement. We therefore included in the model both cognitive (i.e., intelligence) and personality (i.e., Big Five) measures, and convergent and divergent thinking measures as predictors of creative achievement. Besides divergent thinking we therefore included as predictor also convergent thinking, which never was tested in a model predicting creative achievement. Convergent thinking has been proposed within different theoretical propositions as an important cognitive style for the understanding of creativity (e.g., Cropley, 2010; Runco, 2003). Convergent thinking is defined as the analytical and evaluative thinking mode that represents the capacity to focus on the best or correct solution (Guilford, 1967; Kleibeuker et al., 2013; Runco, 2004). Chermahini and Hommel (2010) proposed that this thinking modality is related to basic cognitive and executive functions (e.g., attention, working memory). In particular, it is involved in routine problems, when the thinker immediately recognizes and applies a method that he already knows to find the solution (Dow & Mayer, 2004). But, more importantly, it is involved in the solution of non-routine problems, when the thinker does not know the appropriate solution

method and must find or invent one (Dow & Mayer, 2004); in this case the solution comes by insight, i.e., by the non-linear reorganization of the common knowledge.

On the basis of the data trend emerged from the first analyses performed at the end of the first period and the data emerged from past research, we hypothesized that the ideational mental state is mainly composed by two thinking modalities able to differently predict creative achievement in the scientific and artistic domains: convergent thinking that is mainly composed by the insight phenomenon and defines the ability to ideate or discover the unique solution, highly related to IQ-based intelligence; divergent thinking, that defines the ability to ideate or explore alternatives and is highly enabled by personality traits. We in particular hypothesised that convergent thinking was able to predict scientific creative achievement, while divergent thinking was the best predictor of artistic creative achievement.

3.1. Method

3.1.1. Participants

155 students from scientific and artistic departments of the University of Bologna who completed the CREAM test battery during the first project period were included in the analysis. However, only participants without missing data were included in the analysis for a total of 120 participants**,** M_{age}= 24.23, *SD*=5.54; 57 females.

3.1.2. Measures

Because of the number of participants, not all measures composing the CREAM test battery were included in the model, but only the basic variables necessary to test our hypotheses. In particular, we used two measures of convergent thinking: the Remote Associates Test (RAT; Mednick, 1962) and insight problems (Dow & Mayer, 2004); a measure of basic cognitive abilities, i.e., the Raven short-form intelligence test (Arthur & Day, 1994). Moreover, we included the three measures of divergent thinking, Title task (Guilford, 1968; rCAB 2011), Figure task (rCAB 2011; Runco & Albert, 1985), Realistic problems task (rCAB 2011; Runco, Dow, & Smith, 2006). Fluency and originality scores were obtained for each participant in the three tasks. The short measure of personality traits (Ten Item Personality Inventory Scale, Goslin et al., 2003) was included. Finally, the Creative Activity and Accomplishment Check list (CAAC; Hocevar, 1981; rCAB, 2011) was included to obtain a measure of creative accomplishment in the scientific, artistic, and everyday domain. For a comprehensive description of these measures see Section 5.2 of the present Deliverable.

3.1.3. Analysis

We analyzed the data using a latent variable structural equation model (SEM). SEM allows indeed to conduct a multivariate analysis of a structural theory, to avoid typical fallacies of correlational research and to analyze the latent relationships between variables. In particular, the model estimation was performed with LISREL software. We used maximum likelihood procedure with robust standard errors in order to account for non-normality in the data and mixed nature of our variables. Latent variables variance was estimated and normalized to 1.

3.2. Results

The analyses showed that the model fit well, X^2=37.88, *df*=26, *p*=0.062, *RMSEA*=0.062. In particular, as hypothesized, convergent thinking is essentially defined by the insight phenomenon (measured as the solution percentage to the insight problems) and highly influenced by cognitive abilities measured by the Raven test. Convergent thinking resulted the main determinant of scientific creative achievement and a negative predictor of artistic creative achievement. No relation between the associative abilities measured by the RAT and convergent thinking emerged. On the other hand, divergent thinking is defined by fluency and originality in producing alternatives, and highly influenced by personality, in particular Extraversion. Divergent thinking resulted the main determinant of artistic creative achievement.

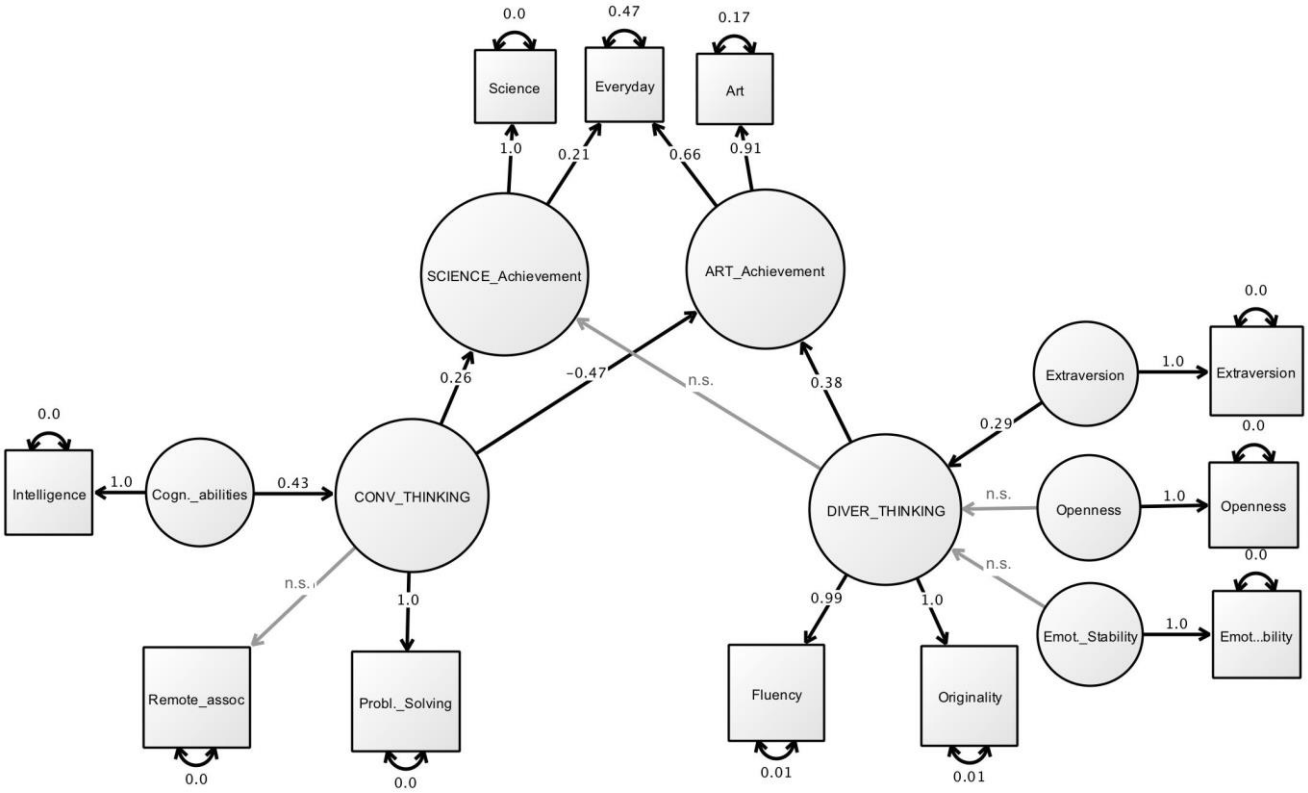

Figure 1. SEM model showing an integrated ideational model.

3.3. Conclusions

Adopting a structural equation modelling approach, we were able to justify a unitary creative thinking model that finds the place for both convergent and divergent thinking: the integrated ideational model. This model confirmed the data trends emerged from the first correlational analyses performed at the end of the first period of the project. In particular, we found that convergent thinking was the main predictor of scientific creative achievement. Convergent thinking in particular was defined by insight, which on the contrary was not related to divergent thinking. Moreover, cognitive abilities emerged as influencing ideation by insight. An additional result emerged from the model showed that the associative abilities measured by RAT were not related to the ideative

processes (as emerged also in Benedek et al. 2012). Finally, we showed that the divergent process (defined by fluency and originality in producing alternative ideas) is the main predictor of artistic achievement and it is influenced by the Extraversion personality trait (Eysenck & Eysenck, 1985; Furnham & Bachtiar, 2008), since extravert participants are more disposed to take risk in producing "unconventional" responses. Lastly, the model showed that scientific and artistic creative achievements are defined also by everyday creative achievement; both domains have indeed a direct relationship with everyday achievement.

This analysis gave important understandings of the relationships between the variables measured within the CREAM test battery. Moreover, it suggested the main directions for the analyses contained in the present deliverable. First of all, we understood the need to expand the participants sample in order to perform separate analyses on the scientific and artistic domains and to confirm the importance of convergent and divergent abilities in the two domains. Moreover, the necessity to include also the creative domain in the analyses to understand how professionals characteristics were related to scientific, artistic, and everyday creativity resulted in a new administration campaign at the Engine group, partner of the Consortium.

4. Introduction to the analyses

The analyses performed on the data collected during the first two periods of the project aimed at exploring the differences and similarities between the creative achievement in different knowledge domains. In particular, as summarized in the title of the present document, the main purpose of the analysis is to define the main predictors of creative achievement in the scientific and artistic domains. To this aim a data collection within these two domains has been performed, administering the CREAM test battery to students from scientific departments and from artistic departments of the University of Bologna. However, since creative achievement cannot be defined considering only the scientific and artistic domains, we included in the analysis a measurement of a general-domain creative achievement: the everyday achievement. The two samples of students were moreover compared with a group of creative professionals from the Engine Group, in the attempt to understand the similarities in the creative achievement in domain-specific (science and art) and in general domain (everyday creativity) contexts.

Final purposes of the analysis are to:

- Identify the different profiles defining the different levels of scientific creative achievement using as a reference sample the science students;
- Identify the different profiles defining the different levels of artistic creative achievement using as a reference sample the art students;
- Identify the different profiles defining the different levels of everyday creative achievement using the entire sample as reference. In the case of differences between art and science students and advertisement professionals, different profiles within each domain will be defined.

Different steps of analyses will be presented. First of all a description of the sample involved in the analyses will be provided, including the adopted data cleaning (section 5.1). Section 5.3 will then describe and provide specific references on the different scoring methods used to score the tests. The following section (5.4) will present the analyses performed to test (where possible) the internal consistency of the instruments used in the battery; this analysis has been provided to confirm the good reliability of the measures emerged from the first set of analysis described in D2.1. Starting from section 6, the correlational analyses between the different measurement instruments of the battery are described; the aim of these analyses is to confirm the associations between the different abilities, tendencies and traits tested within the battery that emerged in Deliverable D2.1. The larger sample obtained at the end of the second period allowed a reliable series of correlational analyses. In section 7 the differences and similarities between the three knowledge domains are explored, in order to understand the differences in the three domains as regards personality, intelligence, creative abilities, and creative achievement. The following section (Section 8) will then define the predictors of creative achievement in scientific, artistic, and everyday domains. In particular, we used hierarchical regressions models to identify the main predictors and mediator analyses, based on the evidences emerged from the previous analyses, to explore any interaction between predictors. Finally, section 9 will describe different profiles defining individuals at different levels of creative achievement (low, medium-low, medium-high, and high) in the scientific, artistic, and everyday domain.

Data analyses have been performed using SPSS 21.0. After the description of each data analysis a discussion on the meaning of the results is provided.

5. Method

5.1. Participants

Starting from the 191 participants involved in the first set of analyses performed at the end of the first period, a second administration campaign has been performed during the second period. Since the sample was highly biased towards the scientific domain (109 science students vs. 47 art students), particular attention has been directed to the data collection within the artistic domain. Moreover, to the purpose to conduct reliable comparisons between the three knowledge domains, a further administration campaign has been performed at the Engine group (36 creatives participated in the first administration campaign).

A total of 173 participants were involved in the second administration campaign. To allow a higher consistency and reliability of the statistical analyses, participants with less than 80% of the data were excluded from the analyses. After the cleaning of the data, the final sample used for statistical analyses, which joins the participants from the two administration campaigns, is composed of 322 participants (177 males). In the following, a description of this sample is provided.

A numerical description of participants is shown in Table 1. 126 students (83 males) from scientific departments are representative of the scientific domain. 127 students (41 males) from artistic departments are representative of the scientific domain. 69 professionals (53 males) from the ENGINE Group are representative of the creative industry domain. The sample is not gender-balanced (χ^2=45.75, p<.001), however this result was in part a consequence of the typical difference in the gender distribution within artistic and scientific study programs. The two scientific and artistic subsamples could therefore be considered good representatives of the scientific and artistic knowledge domains. Moreover, Table 1 shows that the purpose of the second administration campaign to balance the number of participants between the scientific and artistic domains has been reached.

Table 1. Count and percentages of participants within the three domains, divided by gender.

			Science	Art	Creatives	Total
Gender	Male	Count	83	41	53	177
		% Domain	65.9%	32.3%	76.8%	57.7%
	Female	Count	43	86	16	145
		% Domain	34.1%	67.7%	23.2%	42.3%
Total		Count	126	127	69	322
		% Domain	100.0%	100.0%	100.0%	100.0%

Participants of the scientific domain were recruited in different scientific departments of the University of Bologna, for example Astrophysics and Cosmology, Chemistry, Informatics Engineering, Mathematics, Physics, and Telecommunication Engineering (see Figure 2 for the complete list of departments). Participants of the artistic domain were recruited in different artistic departments of the University of Bologna, for example Design, Drama Art and Music studies, Fashion techniques and culture, and Visual Arts (see Figure 3 for the complete list of departments). The participants involved at the Engine Group were characterized by different work specializations, including, for example, art director, copywriter, creative, or creative director.

A low number of participants from the scientific and the artistic domains were previously involved in a creative training/course (4.8% and 5.7% for the scientific and the artistic domain, respectively). A higher percentage of participants (29%) from the creative industry domain were involved in a training of creativity before the CREAM administration; this percentage is fully understandable, given the type of work characterizing this domain.

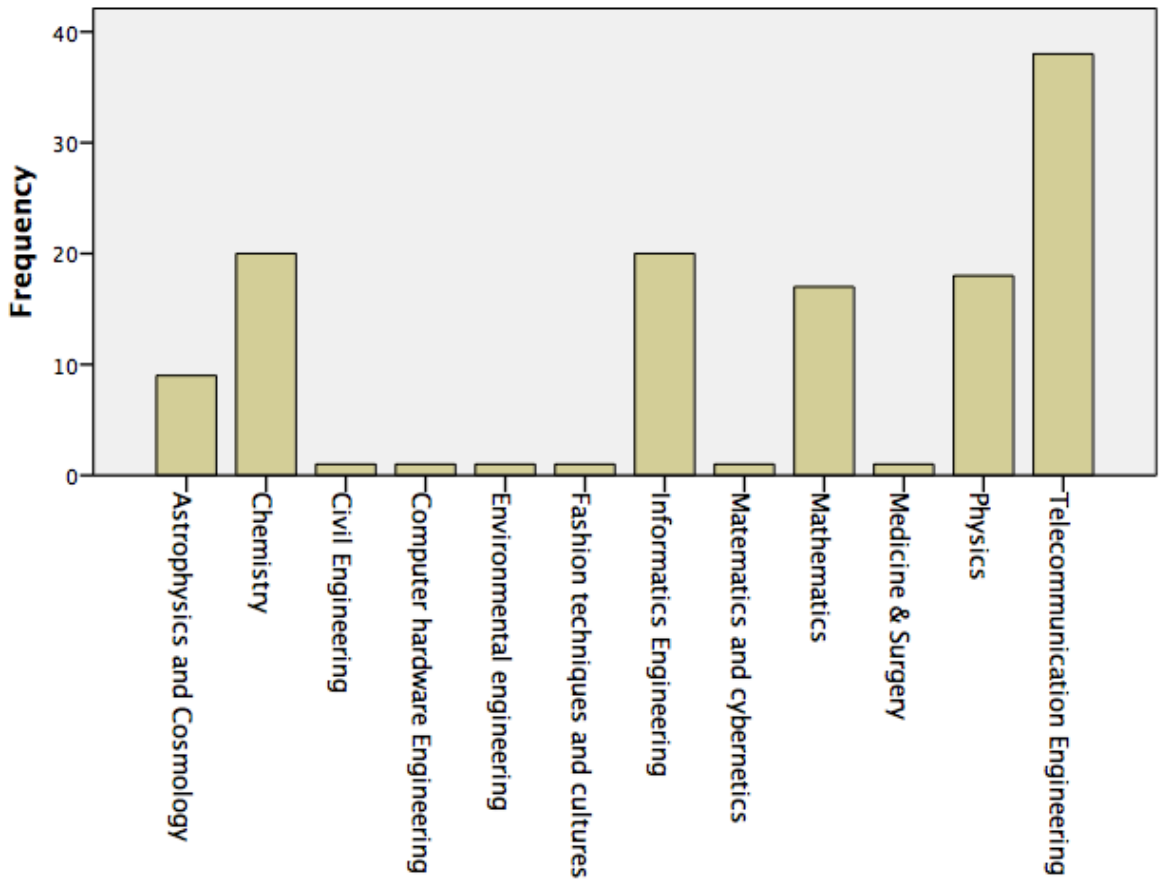

Figure 2. Specialisation of the participants from the scientific domain.

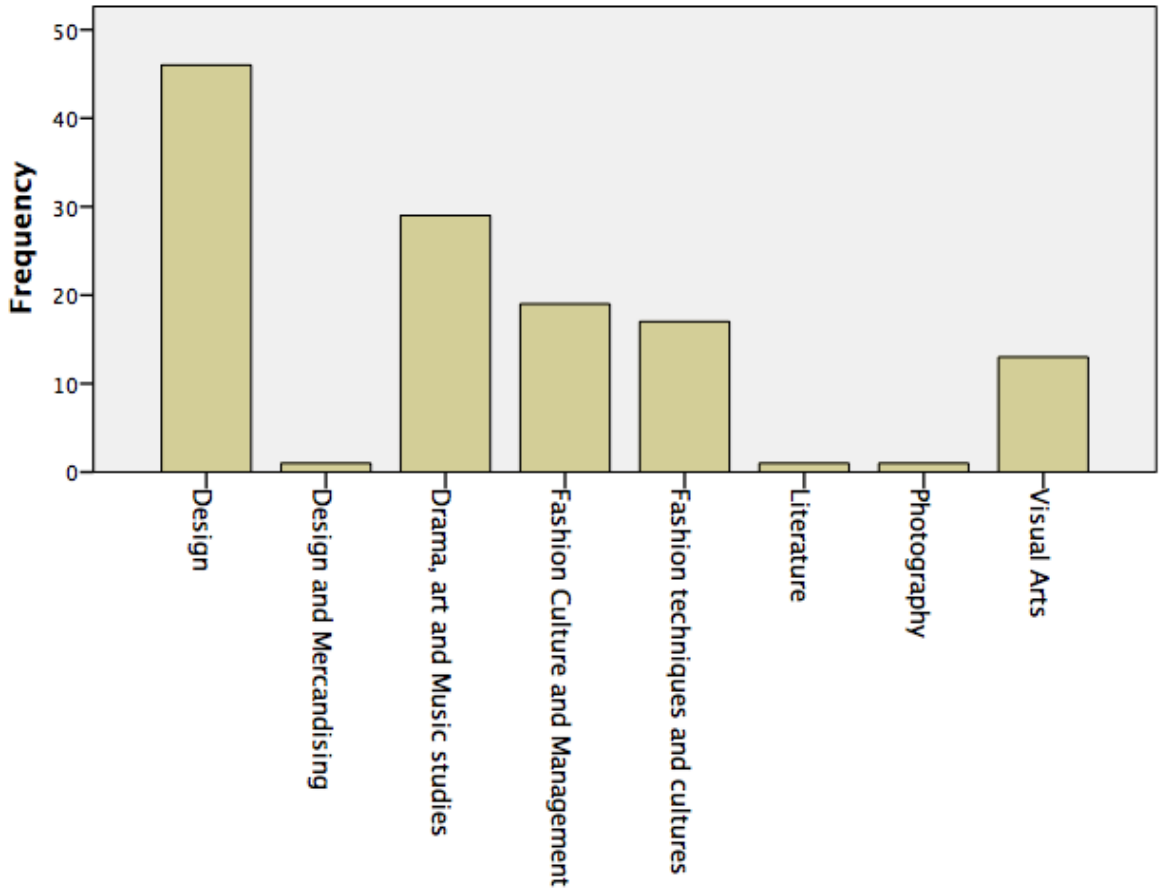

Figure 3. Specialisation of the participants from the artistic domain.

5.2. Measures: the CREAM test battery

A brief description is provided in this section of the measures constituting the CREAM test battery. For a comprehensive and exhaustive description of the CREAM test battery please refer to Deliverable D2.1 and to Annex D2.1.1.

5.2.1. Remote Associates Test (RAT)

The Remote Associates Test (RAT) was developed by Mednick (1962) as a measure of creative thought that does not require specific knowledge of any field. Each question on the RAT is composed of three apparently unrelated cue words (triplet) that associate to or associate from a fourth word, which is the correct answer. This test is typically used to study insight or insight-like phenomena, as upon solving RAT items solvers often have an "Aha!" experience. Since remote associate problems have a single-word, unambiguous solution, RAT is used in the CREAM test battery as a task for testing the verbal convergent thinking (CT) ability.

Eighteen different semantically associated triplets have been chosen for the CREAM test battery. Each triplet has been selected from literature. In particular, triplets of different difficulties have been selected (the difficulty of a triplet is defined by the percentage of

participants that accurately finds the associated word). Finally, according to the literature (see Bowden & Jung-Beeman, 2003) a time limit of 30 seconds is given to the participants to solve each problem.

5.2.2. Insight Problems

A varied selection of insight problems is found in a paper published by Dow and Mayer in 2004. Insight problems may be seen as a special type of non-routine problems in which the problem primes an inappropriate solution procedure that is usually familiar to the problem solver (Dow & Mayer, 2004). During an insight problem the problem solver must overcome this familiar way of looking at the problem and invent a novel approach. Dow and Mayer (2004) in particular categorized the insight problems into verbal, mathematical, and spatial problems.

In the CREAM test battery a selection of 9 problems has been made, choosing 3 verbal, 3 mathematical, and 3 spatial problems. Participants are asked to find the solution to these nine problems.

5.2.3. Titles Task

Titles task is a measure of participants' divergent thinking. It is one of the divergent thinking tests used in the rCAB, the creativity assessment battery developed by Mark Runco (http://creativitytestingservices.com/) and a divergent test widely used in the literature (Guilford, 1968). In particular, this task asks to produce some alternative titles for some widely known books or movies. This task is considered one of the best divergent thinking tasks, as a person must be both original and give fitting ideas. For adapting the use of this task to the Italian culture, two books and one movie that are very well known to Italian audience have been chosen. For its use in the English culture two books and one movie already used for the testing in this culture are used.

Divergent tests do not concern the identification of the right response, but they aim at stimulating the production of alternatives for some wide and ill-defined problems. To stimulate the production of alternative titles, participants are reassured on the fact that the task does not concern any grades and that their ideas are confidential. Moreover, they are asked to have fun in the production of alternatives and that the more ideas, the better.

5.2.4. Figures Task

Figures task is a divergent thinking task included in the rCAB by Runco. Differently from the verbal tasks, figural tasks are usually associated to higher originality scores, as verbal tasks are more constrained than abstract figural tasks (Runco & Albert, 1985). In particular, in the CREAM test battery three abstract black and white line drawings are used and participants are asked to list all off the things they can think of that each figure could represent.

5.2.5. Realistic Problems Task

The third divergent thinking task is based on some realistic problems. Literature showed that realistic tasks have an advantage for fluency because they are more interesting, by virtue of their realism, or because the individual has more experience and, therefore, information (Runco, Dow, & Smith, 2006). In particular the problems used in the CREAM test battery derive from the tasks used in the rCAB by Runco and

already used in past researches (e.g., Runco, Illies, & Eisenman, 2005). This realistic task asks open-ended questions, but differently from the other two divergent tasks Realistic Problems Task is focused on situations that participants (students or professionals) can actually experience. The task indeed describes three problems, which may occur in participants' everyday life.

5.2.6. Judgment Task

Judgement task is a measure of participants' evaluation ability. The Judgement of ideas task was previously used in a series of researches to measure the assessment ability (Runco, 2013; Runco & Acar, 2012; Runco & Chand, 1994). The version used in the CREAM test battery represents an adaptation of the Judgement Task used in the rCAB. Participants are asked to judge the originality of 10 uses of five different common objects on a 7-point scale (from 1 "Highly conventional/unoriginal", to 5 "Highly original"). In particular the uses included in this Task were derived from the uses produced in a previous study by 30 students of the same age range of the students involved in the CREAM project (Agnoli, Franchin, Rubaltelli, & Corazza, 2015). In this study the students were asked to produce as many uses as they could think of for some common objects. The originality of the uses was rated by two independent expert raters on the basis of an originality scale. An average rating of raters' assessment was derived for each use. The 5 most original and the 5 least original uses produced in this previous study have then been chosen for each of the five common objects and included in the Judgement Task of the CREAM test battery. They are listed and presented to the participants in an alphabetical order.

5.2.7. Creative Achievement Questionnaire (CAQ)

Creative achievement is assessed by the Creative Achievement Questionnaire (CAQ; Carson et al., 2005). This questionnaire measures creative accomplishments in 10 domains: Visual Arts, Music, Dance, Architectural Design, Creative Writing, Humor, Inventions, Scientific Discovery, Theater and Film, and Culinary Arts. The CAQ aims to capture Pro-c or Big-C creativity (Silvia, Wigert, Reiter-Palmon, & Kaufman, 2012) and it focuses on significant, observable accomplishments. Carson et al. (2005) proposed a two factors solution for the CAQ scores, explaining creative achievement in the scientific and artistic domain.

5.2.8. Creative Activity and Accomplishment Check list (CAAC)

The Creative Activity and Accomplishment Check list (CAAC) is a self-report measure of creative achievement in different life domains. It was first used by Hocevar (1981) and than frequently used in creativity research (e.g., Milgram & Hong, 1999; Runco, Noble, & Luptak, 1990) and included in the rCAB by Runco. The original version of the scale measures creative accomplishments in many domains. The version used in the CREAM test battery uses 45 items to measure creativity accomplishments in the artistic, scientific, and everyday life domains. Each item represents an activity performed in one of these three domains.

The scale uses a four-point ordinal response scale. Participants, in particular, are asked to complete each item using the following scale: A = Never did this, B = Did this once or twice, C = 3–5 times, and D = More than 5 times. To take into account also the different levels of motivation in creative activities, each item asks how many times they

performed an activity both within (low motivation) and outside (high motivation) the scholastic/working environment. Participants must respond to the list of activities and accomplishments in the various fields of study. They must circle the response (A-D) that best describes the frequency of the activity both inside and outside the school/work, i.e., how often they have done each of the activities in school and outside the school/work.

5.2.9. Raven's Advanced Progressive Matrices (APM) short form

Raven's Advanced Progressive Matrices are one of the most used intelligence tests in Europe. They are widely employed to assess fluid ability in adolescents and adults (Raven & Raven, 2008). Raven's APM have a high external validity (e.g., they consistently predict success in career). However, since Raven's APM are a measurement of fluid, figural intelligence, they cannot fully account for different kind of intelligent performances. A limitation of this test is its length: to shorten the administration time, we included in the CREAM test battery a short form of the test (APM-SF) developed by Arthur and Day (1994; Chiesi et al., 2012). This short-form is composed of items 1, 4, 8, 11, 15, 18, 21, 23, 25, 30, 31, and 35 of the APM – II Set (see APM Manual; Raven, Raven, & Court, 1998). Consistently with the long form, 3 items derived from Set I were used for practice before completing the APM – SF.

5.2.10. Self-Efficacy Scale

Bandura (1997) suggested that a strong self-efficacy is an important requirement for creativity. This ability influences performance through the adept use of sub-skills, inventiveness, and resourcefulness (Bandura, 1984, 1986). This personality attitude is defined by Bandura (1997) as ''beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments'' (p. 3). Psychological research demonstrated the importance of self-efficacy to creativity (see for example Lubart, 1994; Prabhu et al., 2008).

Self-efficacy is measured in the CREAM test battery by the General Self-Efficacy Scale (Schwarzer, 1993), which is a ten-items scale that aims at measuring a broad and stable sense of personal competence to deal effectively with a variety of stressful situations. Participants are instructed to choose a number next to each of the 10 statements to indicate the extent to which the statement is true or not true for them using a four-point scale, from 1 "Not at all true" to 4 "Exactly true".

5.2.11. Ten Item Personality Inventory Scale (TIPI)

The TIPI Scale is included into the Big-Five theoretical framework, which is a hierarchical model of personality traits with five broad factors. According to this framework, the individual differences in human personality can be classified into five dimensions: Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability.

Among different rating instruments developed to measure the Big-Five dimensions, TIPI has been demonstrated to allow a rapid and valid assessment of the five factors (Goslin et al.. 2003). In this 10-items inventory, each item of the scale represents one pole of the five dimensions. In particular, each item consists of two descriptors, separated by a comma, using the common stem, ''I see myself as:''. Each of the five items is rated on a 7-point scale ranging from 1 (disagree strongly) to 7 (agree strongly). Participants are instructed to write one of the seven numbers next to each of the 10 couple of descriptors

to indicate the extent to which they see themselves accordingly to this couple of adjectives.

5.2.12. Work Preference Inventory (WPI)

The Work Preference Inventory (WPI) was designed as a direct, explicit assessment of individual differences in the degree to which adults (and college students) perceive themselves to be intrinsically and extrinsically motivated toward what they do (Amabile et al., 1994). Motivation is a concept highly related to creativity (Prabhu et al., 2008). Two forms of motivation in particular have been studied in relation to creativity: intrinsic motivation, the motivation to engage in an activity primarily for its own sake, because the activity itself is interesting, engaging, or in some way satisfying; extrinsic motivation, the motivation to work primarily in response to something apart from the activity itself, such as reward or recognition or the dictates of other people (Amabile et al., 1994).

Correlations between WPI scores and behavioural creativity measures showed that intrinsic scores correlated positively with creativity, and extrinsic scores correlated negatively with creativity (Amabile et al., 1994). Even if the original version of the WPI containing 30 items was written for working adults, it was readapted, rewriting some items, for college students. In particular the CREAM test battery uses this college student form for the administration to university students, while it included the form for workers in the administration to professionals.

5.3. Data scoring

Self-report questionnaires and tasks performance were mainly scored according to the literature.

Convergent tasks (RAT and problem solving) were scored calculating the probability of solutions (Bowden & Jung-Beeman, 2003; Dow & Mayer, 2004), obtaining a mean solution probability for each participant (from 0 to 1).

From divergent tasks (Figures, Titles, and Realistic Problems task) scores two criteria were derived: fluency and originality. In comparison to the scoring procedure performed during the first set of analyses, the frequency score was here excluded. Frequency is usually derived from the frequency of appearance within the sample of each alternative produced by a participant. Since we included in the set of analyses described in the present deliverable the originality score, frequency would essentially result as a redundant score, since originality score takes into account also the frequency of appearance of an alternative within the sample. The participants totally generated 8313 alternative responses in the Figures Task, 5459 alternatives in the Titles Task, and 4390 alternatives in the Realistic Problem Task. Three independent raters evaluated the originality of each alternative response within each response set produced in the three divergent tasks. All responses were transcribed into a spreadsheet and then sorted alphabetically within each of the three trials required for each divergent task. This method ensured that the raters were blind to several factors that could bias their ratings: the response serial position in the set, the total number of responses in the set, and the preceding and following responses. The raters read all the responses prior to scoring them, and they scored the responses separately. Each response received a rating on a 1 (not at all original) to 5 (highly original) scale using the procedure proposed by Silvia and colleagues (2008). In particular, they used the scoring criteria proposed by

Wilson, Guilford, and Christensen (1953) on individual differences in originality. In their model, creative responses are uncommon, remote, and clever. The raters were told to consider all three dimensions when making their ratings, and they were told that strength in one facet could balance weakness in another facet (Silvia et al., 2008). Inter-rater reliability calculated on all the alternatives produced by the participants was good (Cohen's $\kappa > .78$). In case of important discrepancies in ratings, raters reviewed and assigned scores by consensus. A final mean originality score was calculated from the scores of the three independent raters. Finally, fluency was scored summing the number of alternatives produced in the three divergent tasks, obtaining a total fluency score for each participant.

Assessment ability was scored calculating the variance of the participants' ratings from the expert coders' ratings (here defined as the norm). In particular, assessment score was calculated as the mean of the absolute values derived from the differences between participant's ratings and expert judges' ratings on the 50 uses presented in the task (10 uses for 5 common objects). This score is therefore a summarizing value, which defines the variance between participants' assessment and expert norm rate, with 0 defining the lack of difference between the two evaluations. The lower the score of the Judgment Task, the higher participant's assessment ability (i.e. the ability to judge in accordance to the norm).

According to Carson et al. (2005), CAQ score was calculated summing the total number of points within each domain to determine the domain score; if an item was marked by an asterisk, we multiplied the number of times the item has been achieved by the number of the question to determine points for that item. Finally, the ten domains scores were summed to obtain a total CAQ score. In the first set of analyses the CAQ scores resulted to be highly related to the artistic creative achievement measured by the CAAC. Even if the CAQ scores emerged to be not able to distinguish between different forms of creative achievement, they were highly useful to confirm the convergent validity of the CAAC instrument. Given the aims of the present deliverable at finding the predictors of creative achievement in different knowledge domains, CAQ scores has been excluded from the analyses, and only the CAAC scores have been used for the scoring of creative achievement.

Scoring of CAAC produced 6 different creative achievement scores for each participant. In particular, we obtained an average score (from a minimum of 0 to a maximum of 4) for: scientific creative achievement within school/work, artistic creative achievement within school/work, everyday creative achievement within school/work, scientific creative achievement outside school/work, artistic creative achievement outside school/work, everyday creative achievement outside school/work. In the analyses presented within this deliverable three creative achievement scores will be presented: scientific creative achievement, that is the average score between scientific creative achievement within and outside school/work; artistic creative achievement that is an average score between artistic creative achievement within and outside school/work; everyday creative achievement that is an average score between everyday creative achievement within and outside school/work. These three scores are therefore constituted by an average score between the creative achievement in extrinsic (inside school/work) and extrinsic (outside school/work) contexts.

Raven was scored by calculating the total number of solutions found by the participants in the 12 trials (Arthur & Day, 1994).

According to Schwarzer et al. (1997) the 10 items of the Self-efficacy scale were summed to obtain a final score indicating the level of a generalized self-efficacy for each participant.

As per the TIPI questionnaire, following the instruction provided by Goslin et al. (2003), we obtained 5 scores for each participant describing his/her mean level of: Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability.

Finally, following the instructions provided by Amabile et al. (1994), we obtained two scores from the scoring of the two WPI inventory subscales, the first representing participant's intrinsic motivation score, the second his/her extrinsic motivation score.

In the following page, a summarizing table showing the main descriptive statistics obtained from the CREAM test battery is presented (Table 2).

Table 2. Main descriptive statistics of the measurement methods included in the CREAM test battery.

	N	Minimum	Maximum	Mean	SD
RAT	314	.00	.94	.50	.19
Insight Problems	324	.00	1.00	.48	.25
Figures Task Fluency	323	6.00	71.00	24.90	10.19
Figures Task Originality	323	1.00	4.58	1.40	.38
Real Problems Task Fluency	314	1.00	33.00	13.89	5.94
Real Problems Task Originality	314	1.00	2.91	1.38	.34
Titles Task Fluency	313	2.00	72.00	16.93	9.63
Titles Task Originality	311	1.00	3.26	1.61	.36
Judgment Task	324	.30	2.61	.95	.32
CAQ	324	.00	260.00	15.73	24.47
CAAC Scientific Achievement	324	1.00	2.79	1.43	.34
CAAC Artistic Achievement	323	1.00	3.32	1.81	.46
CAAC Everyday Achievement	324	1.00	3.64	2.12	.46
Raven	323	1.00	12.00	8.86	2.47
Self Efficacy	323	16.00	40.00	29.65	4.07
Extraversion	323	1.00	7.00	4.29	1.45
Agreeableness	323	1.50	7.00	4.66	1.18
Conscientiousness	323	2.00	7.00	5.19	1.28
Emotional Stability	323	1.00	7.00	4.18	1.51
Openness	323	2.50	7.00	5.76	1.00
Intrinsic Motivation	321	19.00	58.00	46.19	6.26
Extrinsic Motivation	322	6.00	55.00	38.00	6.70

5.4. Measure reliability

We used the scoring of the Cronbach's alpha for measuring the reliability of the tests. However, some tests, because of their structure and nature, cannot be statistically tested for their internal consistency. This is the case for example for the CAQ questionnaire, which structure did not allow a conventional internal consistency analysis, the TIPI inventory, which is constituted only by 2-item subscales that do not allow a convincing reliability analysis, and the divergent tasks.

As shown in Table 3 all internal consistency of the tests resulted from acceptable to good. This result confirmed what emerged from the first set of analyses. All tests in particular, thanks to the increase of the sample, resulted in an enhancement or maintenance of their internal consistency value.

Table 3. Internal consistency for the tests used in the CREAM test battery.

	Cronbach's Alpha	N. of items
RAT	.79	18
Insight Problems	.69	9
CAAC Scientific Achievement	.88	34
CAAC Artistic Achievement	.86	28
CAAC Everyday Achievement	.86	28
Raven	. 69	12
Self Efficacy	.78	10
Intrinsic Motivation	.72	15
Extrinsic Motivation	.69	15

5.5. Procedure

A second administration campaign was performed at the University of Bologna and at the Engine Group, in order to collect an adequate number of participants to conduct appropriate and specific analyses in the scientific and artistic domains and to conduct appropriate comparisons with the advertisement professionals group. Starting from January 2015 to October 2015, administration was performed in several Departments of the University of Bologna. On June 2015 an entire day was devoted to the collection of data at the Engine Group. During this day a specific training was given by the examiner of the CREAM test battery to a professional of the Engine partner in order to allow further independent administrations of the test battery. For the administration at the Engine Group we used a version of the test battery re-adapted for the use within a working environment (using for example the WPI version adapted for work settings).

The entire administration of the battery lasts for 2 hours. Following the administration procedure used during the first administration campaign, given the complexity of the battery, the administration was divided in three parts balanced in terms of both duration and task type (for more information on the administration and the timing of the tasks, please refer to the CREAM battery manual presented in Annex D2.1.1). After the completion of each part, a short break was granted to the participants. Moreover, in order to avoid a cognitive overload, after each task a brief explanation of the task was provided by the examiner. In order to reduce an experimenter effect the administration of the battery was performed by a single examiner (with the exception of the trained examiner at Engine). This allowed for consistency in the instructions provided to the participants.

Before the administration, the examiner provided the participants with some information about the CREAM project, and the general aims and structure of the test battery were explained. Moreover, participants were reassured on the anonymity and the privacy of the data. The three parts of the test were classified and coupled by means of the birth date, which participants had to write on the first sheet of the three parts.

6. Correlational analysis

Results obtained from correlation analyses are organized accordingly to the two main measures of the creative behaviour used in the test battery: creative abilities and creative achievement. A first section presents the associations between convergent, divergent and assessment abilities, and their association with personality and intelligence measures. A second section presents the associations of creative achievement in the scientific, artistic, and everyday domains with personality and intelligence measures as well with convergent, divergent, and assessment abilities.

6.1. Creative abilities

6.1.1. Ideation: convergent and divergent abilities

Pearson's correlations showed that divergent and convergent tasks are essentially unrelated tasks (Table 4). Neither insight problems nor the RAT indeed show significant associations with the three divergent tasks (Figures, Realistic problems, and Titles tasks), and in particular with fluency and originality. Convergent and divergent tasks evaluate therefore separate abilities. This result confirms the data trend emerged from the first set of analyses and from the preliminary analysis and is sustained by past literature sustaining the complementary but different attributes of convergent and divergent thinking (e.g. Guilford, 1950).

The only significant correlations between convergent and divergent tasks that emerged from the analyses are the positive associations between insight problems and the Realistic problems fluency and originality. Even if these associations are of slight entity, they could testify a relationship between the ability to solve problems through insight and the ability to produce many and original alternative solutions to realistic problems. This result could be in part justified by the fact that the Realistic problems Task is the only divergent task that requires to produce real solutions to solve a problematic situation. On the contrary, Figures and Titles tasks do not require producing solutions to problems, but only alternative ideas starting from a common title or an abstract figure.

High associations emerged from the analyses within convergent and divergent tasks. The positive association between RAT and insight problems testifies a relationship between the two convergent tasks, and in particular the fact that both are characterized by the necessity by the participant to find a unique correct solution. High associations emerged between the fluency of the three divergent tasks. This result testifies that the fluency ability is a common ability within the divergent tasks. Slightly lower correlations emerged between the originality scores of the three divergent tasks; this result could suggest that originality is a measure more sensitive to the context of the task (the originality rating takes indeed into account also the appropriateness of the response in relation to the task). The same trend emerged also in exploring the relationship between fluency and originality scores within each divergent task; even if these are always positively associated, the relationship between the two variables changes in the three tasks, testifying that this association is affected by the different context.

Table 4. Correlations between convergent and divergent abilities.

		RAT	Insight Problems	Figures Task Fluency	Figures Task Originality	Real Problems Task Fluency	Real Problems Task Originality	Titles Task Fluency	Titles Task Originality
RAT	r	1	,416**	,043	-,083	,099	,080	,000	,001
	Sig.		,000	,450	,143	,086	,164	1,000	,980
	N	314	314	313	313	304	304	312	310
Insight Problems	r		1	,101	-,018	,222**	,132*	,015	,110
	Sig.			,071	,750	,000	,020	,785	,053
	N		324	323	323	314	314	313	311
Figures Task Fluency	r			1	,130*	,622**	,296**	,642**	,242**
	Sig.				,019	,000	,000	,000	,000
	N			323	323	313	313	313	311
Figures Task Originality	r				1	,227**	,436**	,294**	,374**
	Sig.					,000	,000	,000	,000
	N				323	313	313	313	311
Real Problems Task Fluency	r					1	,312**	,607**	,253**
	Sig.						,000	,000	,000
	N					314	314	303	301
Real Problems Task Originality	r						1	,286**	,490**
	Sig.							,000	,000
	N						314	303	301
Titles Task Fluency	r							1	,217**
	Sig.								,000
	N							313	311
Titles Task Originality	r								1
	Sig.								
	N								311

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

6.1.2. Assessment and ideation

A first exploration of the analyses presented in Table 5 shows that, as sustained also by Runco (Runco & Charles, 1993), assessment and divergent thinking are two distinct abilities within the creative thinking process, highlighting the importance of analyzing them separately in the measurement of creativity. This result confirmed the data analysis presented at the end of the first period of the project.

However, even if past literature already explored the relationships between divergent and assessment ability, no research explored the associations between convergent thinking and assessment ability. The analysis performed at the end of the first period highlighted a slight negative correlation between the two abilities. Table 5 shows a similar trend. Insight problems and particularly RAT task show a significant negative association with the assessment ability. This result shows that with the increase of the assessment ability (higher the scores in the judgment task lower the consensus of participants' rates with the norm) the ability to solve insight problems (in particular verbal problems) and the ability to find the right words associated with the three words proposed in the triplets increase. According to these results the convergent and assessment abilities seem associated, suggesting that they are distinct abilities but associated by common elements. We could hypothesize that this element is to have a reference point, that in the case of the assessment ability is the norm and in the case of the convergent ability is the right answer. Like the convergent ability concerns the ability to converge to a correct answer, the assessment ability indeed concerns a convergence, a comparison with established, defined rules (cultural, social, etc.) through which to evaluate a product, an idea, or, as in the case of the Judgment task, an uncommon use.

6.1.3. Personality and creative abilities

Starting with the analyses on the relationships between convergent abilities (measured through the insight problems and RAT) and personality (measured through the Big 5 personality traits, motivational tendencies and self-efficacy), results highlighted only slight associations between the variables (Table 6). This result testifies that convergent abilities and personality (intended both as Big 5 traits and as attitudes like intrinsic or extrinsic motivation or self-efficacy) are slightly associated variables. Even if literature suggested that creativity and personality (in particular Openness and Extraversion, see Agnoli, Franchin, Rubaltelli, & Corazza, 2015; Batey and Furnham, 2006; Feist, 1988), motivation (in particular intrinsic motivation, see Prabhu et al., 2008), and self-efficacy (see for example Lubart, 1994; Prabhu et al., 2008) are related phenomena, past studies investigated only divergent abilities, excluding from the analyses convergent abilities. Accordingly to the results emerged from the present analyses and from the analyses of the first period, we can assume that finding the right solution is essentially unrelated to personal tendencies or, if we consider the negative association between Openness, Extraversion, Agreeableness and insight problems, slightly negatively associated. The only positive association emerged from this analysis shows a positive association between the RAT scores and intrinsic motivation. This result testifies that finding the right association is favoured in individuals characterized by a tendency to be intrinsically motivated.

Table 5. Correlations between assessment and convergent and divergent abilities.

		RAT	Insight Problems	Figures Task Fluency	Figures Task Originality	Real Problems Task Fluency	Real Problems Task Originality	Titles Task Fluency	Titles Task Originality	Assessment
RAT	r	1	,416**	,043	-,083	,099	,080	,000	,001	-,404**
	Sig.		,000	,450	,143	,086	,164	1,000	,980	,000
	N	314	314	313	313	304	304	312	310	314
Insight Problems	r		1	,101	-,018	,222**	,132*	,015	,110	-,167**
	Sig.			,071	,750	,000	,020	,785	,053	,003
	N		324	323	323	314	314	313	311	324
Figures Task Fluency	r			1	,130*	,622**	,296**	,642**	,242**	-,066
	Sig.				,019	,000	,000	,000	,000	,236
	N			323	323	313	313	313	311	323
Figures Task Originality	r				1	,227**	,436**	,294**	,374**	,068
	Sig.					,000	,000	,000	,000	,223
	N				323	313	313	313	311	323
Real Problems Task Fluency	r					1	,312**	,607**	,253**	-,111
	Sig.						,000	,000	,000	,050
	N					314	314	303	301	314
Real Problems Task Originality	r						1	,286**	,490**	-,068
	Sig.							,000	,000	,231
	N						314	303	301	314
Titles Task Fluency	r							1	,217**	-,018
	Sig.								,000	,748
	N							313	311	313
Titles Task Originality	r								1	-,081
	Sig.									,155
	N								311	311
Assessment	r									1
	Sig.									
	N									324

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

Table 6. Correlations between convergent abilities and personality dimensions.

		RAT	Insight Problems	Extraversion	Agreeableness	Conscientiousness	Emotional stability	Openness	Intrinsic motivation	Extrinsic Motivation	Self efficacy
RAT	r	1	,416**	-,124*	-,077	,023	-,030	-,037	,167**	-,010	,012
	Sig.		,000	,029	,177	,679	,603	,511	,003	,861	,830
	N	314	314	313	313	313	313	313	311	312	313
Insight Problems	r		1	-,119*	-,141*	,015	,073	-,132*	-,012	-,062	,016
	Sig.			,032	,011	,785	,190	,017	,830	,267	,769
	N		324	323	323	323	323	323	321	322	323
Extraversion	r			1	,157**	-,069	-,039	,346**	,132*	,071	,227**
	Sig.				,005	,215	,480	,000	,018	,203	,000
	N			323	323	323	323	323	320	321	322
Agreeableness	r				1	,031	,240**	,125*	,020	-,073	,129*
	Sig.					,581	,000	,024	,727	,190	,021
	N				323	323	323	323	320	321	322
Conscientiousness	r					1	,288**	,033	-,065	,101	,159**
	Sig.						,000	,553	,243	,070	,004
	N					323	323	323	320	321	322
Emotional stability	r						1	-,111*	-,011	-,050	,286**
	Sig.							,047	,838	,371	,000
	N						323	323	320	321	322
Openness	r							1	,311**	,007	,316**
	Sig.								,000	,902	,000
	N							323	320	321	322
Intrinsic motivation	r								1	,210**	,343**
	Sig.									,000	,000
	N								321	321	320
Extrinsic Motivation	r									1	,062
	Sig.										,271
	N									322	321
Self efficacy	r										1
	Sig.										
	N										323

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

Table 7. Correlations between divergent abilities and personality traits.

		Real Problems Task Fluency	Figures Task Fluency	Titles Task Fluency	Real Problems Task Originality	Figures Task Originality	Titles Task Originality	Extraversion	Agreeableness	Conscientiousness	Emotional stability	Openness
Real Problems Task Fluency	r	1	,622**	,607**	,312**	,227**	,253**	,246**	,097	-,065	,162**	,158**
	Sig.		,000	,000	,000	,000	,000	,000	,086	,254	,004	,005
	N	314	313	303	314	313	301	313	313	313	313	313
Figures Task Fluency	r		1	,642**	,296**	,130*	,242**	,317**	,046	-,008	,137*	,278**
	Sig.			,000	,000	,019	,000	,000	,408	,885	,014	,000
	N		323	313	313	323	311	322	322	322	322	322
Titles Task Fluency	r			1	,286**	,294**	,217**	,274**	,085	-,045	,090	,260**
	Sig.				,000	,000	,000	,000	,134	,425	,113	,000
	N			313	303	313	311	312	312	312	312	312
Real Problems Task Originality	r				1	,436**	,490**	,176**	,011	-,118*	,038	,170**
	Sig.					,000	,000	,002	,852	,036	,500	,002
	N				314	313	301	313	313	313	313	313
Figures Task Originality	r					1	,374**	,201**	,164**	-,175**	,057	,094
	Sig.						,000	,000	,003	,002	,311	,091
	N					323	311	322	322	322	322	322
Titles Task Originality	r						1	,170**	,032	-,098	,073	,236**
	Sig.							,003	,575	,086	,199	,000
	N						311	310	310	310	310	310
Extraversion	r							1	,157**	-,069	-,039	,346**
	Sig.								,005	,215	,480	,000
	N							323	323	323	323	323
Agreeableness	r								1	,031	,240**	,125*
	Sig.									,581	,000	,024
	N								323	323	323	323
Conscientiousness	r									1	,288**	,033
	Sig.										,000	,553
	N									323	323	323
Emotional stability	r										1	-,111*
	Sig.											,047
	N										323	323
Openness	r											1
	Sig.											
	N											323

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

Table 8. Correlations between divergent abilities, motivation, and self-efficacy.

		Real Problems Task Fluency	Figures Task Fluency	Titles Task Fluency	Real Problems Task Originality	Figures Task Originality	Titles Task Originality	Intrinsic motivation	Extrinsic motivation	Self efficacy
Real Problems Task Fluency	r	1	,622**	,607**	,312**	,227**	,253**	,167**	,042	,283**
	Sig.		,000	,000	,000	,000	,000	,003	,457	,000
	N	314	313	303	314	313	301	312	312	313
Figures Task Fluency	r		1	,642**	,296**	,130*	,242**	,200**	,126*	,309**
	Sig.			,000	,000	,019	,000	,000	,023	,000
	N		323	313	313	323	311	320	321	322
Titles Task Fluency	r			1	,286**	,294**	,217**	,124*	,114*	,226**
	Sig.				,000	,000	,000	,029	,044	,000
	N			313	303	313	311	310	311	312
Real Problems Task Originality	r				1	,436**	,490**	,199**	-,052	,166**
	Sig.					,000	,000	,000	,357	,003
	N				314	313	301	312	312	313
Figures Task Originality	r					1	,374**	,114*	-,009	,144**
	Sig.						,000	,042	,868	,010
	N					323	311	320	321	322
Titles Task Originality	r						1	,238**	,028	,232**
	Sig.							,000	,622	,000
	N						311	308	309	310
Intrinsic motivation	r							1	,210**	,343**
	Sig.								,000	,000
	N							321	321	320
Extrinsic motivation	r								1	,062
	Sig.									,271
	N								322	321
Self efficacy	r									1
	Sig.									
	N									323

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

Table 9. Correlations between assessment ability and personality.

		Assessment	Extraversion	Agreeableness	Conscientiousness	Emotional stability	Openness	Intrinsic motivation	Extrinsic motivation	Self efficacy
Assessment	r	1	,121*	,093	-,007	-,034	-,074	-,209**	-,085	-,058
	Sig.		,030	,097	,898	,540	,182	,000	,127	,297
	N	324	323	323	323	323	323	321	322	323
Extraversion	r		1	,157**	-,069	-,039	,346**	,132*	,071	,227**
	Sig.			,005	,215	,480	,000	,018	,203	,000
	N		323	323	323	323	323	320	321	322
Agreeableness	r			1	,031	,240**	,125*	,020	-,073	,129*
	Sig.				,581	,000	,024	,727	,190	,021
	N			323	323	323	323	320	321	322
Conscientiousness	r				1	,288**	,033	-,065	,101	,159**
	Sig.					,000	,553	,243	,070	,004
	N				323	323	323	320	321	322
Emotional stability	r					1	-,111*	-,011	-,050	,286**
	Sig.						,047	,838	,371	,000
	N					323	323	320	321	322
Openness	r						1	,311**	,007	,316**
	Sig.							,000	,902	,000
	N						323	320	321	322
Intrinsic motivation	r							1	,210**	,343**
	Sig.								,000	,000
	N							321	321	320
Extrinsic motivation	r								1	,062
	Sig.									,271
	N								322	321
Self efficacy	r									1
	Sig.									
	N									323

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

On the contrary, and consistent with the results of past research and of the preliminary analysis performed at the end of the first period, divergent abilities (here intended as fluency and originality of the alternative responses produced in the Figures, Realistic Problems, and Tittles tasks) and personality traits and tendencies are positively associated. Table 7, in particular, shows that fluency and originality in the three divergent tasks are positively associated, in accordance with past research (see for example see Agnoli, Franchin, Rubaltelli, & Corazza, 2015; Batey & Furnham, 2006), with Extraversion and Openness personality traits. Higher level of Extraversion and Openness are associated with a higher performance in the three divergent thinking tasks. This result confirmed what also emerged in the SEM analysis performed on the dataset of the first period of the project. The correlations in Table 7 show that Titles Task fluency and originality, in particular, were associated with the Openness personality trait.

At the same time, the analyses (Table 8) show significant positive associations between the divergent tasks performance and intrinsic motivation and self-efficacy. Even if slightly negative associations emerged between some divergent scores and extrinsic motivation, a clear positive trend emerged between divergent scores and intrinsic motivation. Higher levels of intrinsic motivation and self-efficacy are indeed associated to higher divergent thinking performance, in accordance with past literature (see for example Lubart, 1994; Prabhu et al., 2008).

Finally, Table 9 shows the correlational analyses between assessment and personality traits and tendencies. On the basis of these results assessment ability and personality seem unrelated variables (only a slight positive association between assessment ability and Extraversion emerged). A significant negative association emerged between assessment ability and intrinsic motivation. This result seems to indicate that the ability to assess accordingly to the norm increased when an individual is motivated by an intrinsic drive. This result compares assessment ability and divergent abilities, both increasing with the increase of the tendency to be intrinsically motivated.

A final consideration can be drawn on the relation between intrinsic motivation and self-efficacy. As emerged from the analyses performed at the end of the first period of the project, the present analysis shows that these personal tendencies are significantly positively associated, testifying that higher levels of intrinsic motivation are associated to higher self-efficacy levels. This result might suggest that, in order to be intrinsically motivated, an individual must also be confident in his/her own abilities to face the task.

6.1.4. Intelligence and creative abilities

The correlations between Raven and convergent tasks (insight problems and RAT) show significant positive associations between the two measurement methods (Table 10). These results indicate that higher levels of intelligence are associated to better solution probabilities in the two convergent tasks, i.e., to higher convergent thinking abilities. On the contrary, intelligence results to be not associated neither with divergent thinking abilities nor with assessment ability (Table 10).

Table 10. Correlations between creative abilities and intelligence.

		RAT	Insight Problems	Figures Task Fluency	Figures Task Originality	Real Problems Task Fluency	Real Problems Task Originality	Titles Task Fluency	Titles Task Originality	Assessment	Raven
RAT	r	1	,416**	,043	-,083	,099	,080	,000	,001	-,404**	,250**
	Sig.		,000	,450	,143	,086	,164	1,000	,980	,000	,000
	N	314	314	313	313	304	304	312	310	314	314
Insight Problems	r		1	,101	-,018	,222**	,132*	,015	,110	-,167**	,416**
	Sig.			,071	,750	,000	,020	,785	,053	,003	,000
	N		324	323	323	314	314	313	311	324	314
Figures Task Fluency	r			1	,130*	,622**	,296**	,642**	,242**	-,066	-,066
	Sig.				,019	,000	,000	,000	,000	,236	,236
	N			323	323	313	313	313	311	323	323
Figures Task Originality	r				1	,227**	,436**	,294**	,374**	,068	,068
	Sig.					,000	,000	,000	,000	,223	,223
	N				323	313	313	313	311	323	323
Real Problems Task Fluency	r					1	,312**	,607**	,253**	-,111	-,111
	Sig.						,000	,000	,000	,050	,050
	N					314	314	303	301	314	314
Real Problems Task Originality	r						1	,286**	,490**	-,068	-,068
	Sig.							,000	,000	,231	,231
	N						314	303	301	314	314
Titles Task Fluency	r							1	,217**	-,018	-,018
	Sig.								,000	,748	,748
	N							313	311	313	313
Titles Task Originality	r								1	-,081	-,081
	Sig.									,155	,155
	N								311	311	311
Assessment	r									1	-,032
	Sig.										,562
	N									324	323
Raven	r										1
	Sig.										
	N										314

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

These analyses suggest that intelligence supports convergent thinking abilities. This trend, and in particular the high association between Raven scores and insight problems solution probabilities, supports the SEM model emerged from the first set of data. Intelligence supports convergent thinking, and in particular the ability to find solutions by insight, and is totally unrelated to divergent thinking and assessment abilities. Raven test measures two main components of a general cognitive intelligence ability (Raven, 2000), and in particular, eductive ability (the ability to generate high level schemata which can allow for an easier handling of complexity) and reproductive ability (the ability to absorb, recall, and reproduce information). These two components have been demonstrated to be good proxies of a general intelligence factor (factor g). However, even if these components are essential to organize the information in order to converge towards a correct solution, they result totally different from the abilities required to obtain a good divergent performance. Different from the ability to generate schemata to organize complexity (conveyed by the eductive ability), for example, divergent thinking tasks require to produce more and more complexity, producing continuously different alternatives.

6.2. Creative achievement

6.2.1. Personality and creative achievement

Past research highlighted that creative achievement is associated with personality trait, in particular with Openness (see for example Agnoli et al., 2015) and Extraversion (see Batey & Furnham, 2008). However, past research mainly explored creative achievement as a general achievement score. In the present analyses we explored creative achievement in the scientific, artistic, and everyday domains. Consistent with the results obtained at the end of the first period of the project and the SEM model obtained on the first set of data, results (see Table 11) show significant positive associations between artistic and everyday creative achievement and Extraversion and Openness traits, but no association emerged between the personality traits and scientific creative achievement. Moreover, higher levels of artistic creative achievement seem slightly associated with lower level of Conscientiousness as emerged also in the meta-analysis performed by Feist (1998) on the relation between personality and creative achievement in the artistic domain.

In the same way, scientific creative achievement is not associated with motivational attitudes, neither with intrinsic motivation nor with extrinsic motivation (see Table 12). On the contrary, artistic and everyday creative achievements are significantly positively associated with intrinsic motivation: a higher tendency to be intrinsically motivated is associated to higher creative achievement in artistic and everyday areas, as emerged also in the research by Prabhu et al. (2008). The only individual tendency that results associated to all three forms of creative achievement is self-efficacy: the higher the self-efficacy level, the higher the creative achievement levels in the scientific, artistic, and everyday domains.

Table 11. Correlations between creative achievement and Big 5 personality traits.

		Scientific achievement	Artistic achievement	Everyday achievement	Extraversion	Agreeableness	Conscientiousness	Emotional stability	Openness
Scientific achievement	r	1	,113*	,303**	,001	-,103	,026	,026	,033
	Sig.		,043	,000	,992	,066	,644	,636	,560
	N	324	323	324	323	323	323	323	323
Artistic achievement	r		1	,718**	,303**	,097	-,159**	,000	,298**
	Sig.			,000	,000	,083	,004	,999	,000
	N		323	323	322	322	322	322	322
Everyday achievement	r			1	,301**	,103	-,060	,012	,236**
	Sig.				,000	,064	,283	,829	,000
	N			324	323	323	323	323	323
Extraversion	r				1	,157**	-,069	-,039	,346**
	Sig.					,005	,215	,480	,000
	N				323	323	323	323	323
Agreeableness	r					1	,031	,240**	,125*
	Sig.						,581	,000	,024
	N					323	323	323	323
Conscientiousness	r						1	,288**	,033
	Sig.							,000	,553
	N						323	323	323
Emotional stability	r							1	-,111*
	Sig.								,047
	N							323	323
Openness	r								1
	Sig.								
	N								323

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

Table 12. Correlations between creative achievement, motivation, and self-efficacy.

		Scientific achievement	Artistic achievement	Everyday achievement	Intrinsic motivation	Extrinsic motivation	Self efficacy
Scientific achievement	r	1	,113*	,303**	,040	-,068	,197**
	Sig.		,043	,000	,477	,223	,000
	N	324	323	324	321	322	323
Artistic achievement	r		1	,718**	,163**	,001	,284**
	Sig.			,000	,003	,983	,000
	N		323	323	320	321	323
Everyday achievement	r			1	,162**	,038	,362**
	Sig.				,004	,492	,000
	N			324	321	322	323
Intrinsic motivation	r				1	,210**	,343**
	Sig.					,000	,000
	N				321	321	320
Extrinsic motivation	r					1	,062
	Sig.						,271
	N					322	321
Self efficacy	r						1
	Sig.						
	N						323

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

6.2.2. Intelligence and creative achievement

The analyses exploring the relationships between creative achievement and intelligence (Table 13) highlight that intelligence is significantly positively associated with scientific creative achievement and negatively associated with artistic creative achievement. No association between Raven scores and everyday creative achievement emerges. These results confirm the data emerged in the SEM model that showed an association of intelligence with convergent thinking that predicted the scientific creative achievement, but not the artistic creative achievement. Moreover, a slightly negative association between intelligence and artistic creative achievement emerged, which seems suggest that the cognitive abilities involved in the Raven test are slightly detrimental to the creative achievement in the artistic domain.

Table 13. Correlations between creative achievement and intelligence.

		Scientific achievement	Artistic achievement	Everyday achievement	Raven
Scientific achievement	r	1	,113*	,303**	,180**
	Sig.		,043	,000	,001
	N	324	323	324	323
Artistic achievement	r		1	,718**	-,155**
	Sig.			,000	,005
	N		323	323	322
Everyday achievement	r			1	-,086
	Sig.				,122
	N			324	323
Raven	r				1
	Sig.				
	N				323

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

6.2.3. Convergent abilities and creative achievement

The correlation analyses between convergent abilities and creative achievement (Table 14) show that convergent tasks scores are positively associated with the scientific creative achievement and negatively associated with the artistic and everyday creative achievement. However, even if both convergent measures correlated negatively with artistic and everyday creative achievement, only insight problems scores correlated positively with scientific achievement. These results therefore show that an increase in insight problem ability is associated with an increase in scientific creative achievement, while it is associated with a decrease in artistic and everyday creative achievement. This result confirms the data emerged form the preliminary analysis performed with the SEM model, where convergent thinking was mainly defined by insight (and less by RAT) and predicted positively scientific creative achievement and negatively artistic creative achievement.

Table 14. Correlations between creative achievement and convergent abilities.

		Scientific achievement	Artistic achievement	Everyday achievement	RAT	Insight problems
Scientific achievement	r	1	,113*	,303**	-,025	,129*
	Sig.		,043	,000	,659	,020
	N	324	323	324	314	324
Artistic achievement	r	,113*	1	,718**	-,141*	-,190**
	Sig.	,043		,000	,012	,001
	N	323	323	323	313	323
Everyday achievement	r	,303**	,718**	1	-,121*	-,139*
	Sig.	,000	,000		,032	,012
	N	324	323	324	314	324
RAT	r	-,025	-,141*	-,121*	1	,416**
	Sig.	,659	,012	,032		,000
	N	314	313	314	314	314
Insight problems	r	,129*	-,190**	-,139*	,416**	1
	Sig.	,020	,001	,012	,000	
	N	324	323	324	314	324

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

6.2.4. Assessment and creative achievement

The correlations between assessment ability (measured through the Judgment task) and creative achievement show a positive association between assessment ability and scientific everyday creative achievement (Table 15). This result seems to suggest that higher creative achievement in science and everyday domains is associated with a lower ability to assess the ideas or solutions: the lower the ability to judge accordingly to the norm, the higher the creative achievement in the scientific and everyday domain.

Table 15. Correlations between creative achievement and assessment ability.

		Scientific achievement	Artistic achievement	Everyday achievement	Assessment
Scientific achievement	r	1	,113*	,303**	,213**
	Sig.		,043	,000	,000
	N	324	323	324	324
Artistic achievement	r		1	,718**	,072
	Sig.			,000	,196
	N		323	323	323
Everyday achievement	r			1	,117*
	Sig.				,035
	N			324	324
Assessment	r				1
	Sig.				
	N				324

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

6.2.5. Divergent abilities and creative achievement

Consistent with past research, divergent thinking performance in positively associated with creative achievement; this result is evident in the association of divergent tasks scores with artistic and everyday creative achievement (Table 16). On the contrary, no association between divergent abilities and scientific creative achievement emerged. In particular, the fluency scores emerged to be highly associated to artistic and everyday creative achievement. Even if to a lesser extent, also originality resulted positively associated to artistic and everyday achievement. However, correlation analyses do not take into account the role of other variables in the association between divergent abilities and creative achievement. Therefore, more specific analyses to understand the role of divergent thinking abilities and the interaction with other variables (e.g., personality or intelligence) in predicting artistic and everyday creative achievement are needed.

Table 16. Correlations between creative achievement and divergent tasks.

		Scientific achievement	Artistic achievement	Everyday achievement	Real Problems Task Fluency	Figures Task Fluency	Titles Task Fluency	Real Problems Task Originality	Figures Task Originality	Titles Task Originality
Scientific achievement	r	1	,113*	,303**	-,025	-,045	,046	,008	-,074	-,010
	Sig.		,043	,000	,651	,430	,417	,889	,184	,864
	N	324	323	324	323	314	313	314	323	311
Artistic achievement	r		1	,718**	,351**	,323**	,375**	,130*	,223**	,141*
	Sig.			,000	,000	,000	,000	,021	,000	,013
	N		323	323	322	313	312	313	322	310
Everyday achievement	r			1	,300**	,283**	,319**	,142*	,218**	,098
	Sig.				,000	,000	,000	,012	,000	,084
	N			324	323	314	313	314	323	311
Real Problems Task Fluency	r				1	,622**	,642**	,296**	,130*	,242**
	Sig.					,000	,000	,000	,019	,000
	N				323	313	313	313	323	311
Figures Task Fluency	r					1	,607**	,312**	,227**	,253**
	Sig.						,000	,000	,000	,000
	N					314	303	314	313	301
Titles Task Fluency	r						1	,286**	,294**	,217**
	Sig.							,000	,000	,000
	N						313	303	313	311
Real Problems Task Originality	r							1	,436**	,490**
	Sig.								,000	,000
	N							314	313	301
Figures Task Originality	r								1	,374**
	Sig.									,000
	N								323	311
Titles Task Originality	r									1
	Sig.									
	N									311

Notes: ** $\alpha \leq 0.01$; * $\alpha \leq 0.05$

7. Comparison between different knowledge domains

7.1. Science vs. Art vs. Creative domains: personality

Before investigating the differences in creative abilities and creative achievement between the three domains analysed within the CREAM project, the differences in personality traits and attitudes and intelligence are explored. These analyses aim at understanding the differences and similarities in these basic variables between the three samples tested in the CREAM project.

A first analysis is devoted to the analyses of the differences in personality traits (Big 5 traits, Figure 4) and attitudes (self-efficacy, Figure 5; motivation, Figure 6) in the scientific, artistic, and creative industry domains. The differences were explored through a multivariate analysis of variance (MANOVA), with the personality score in the five traits as dependent variable and the domain as independent variable (three levels: science, art, and creative). Post-hoc analyses (with Bonferroni's correction)

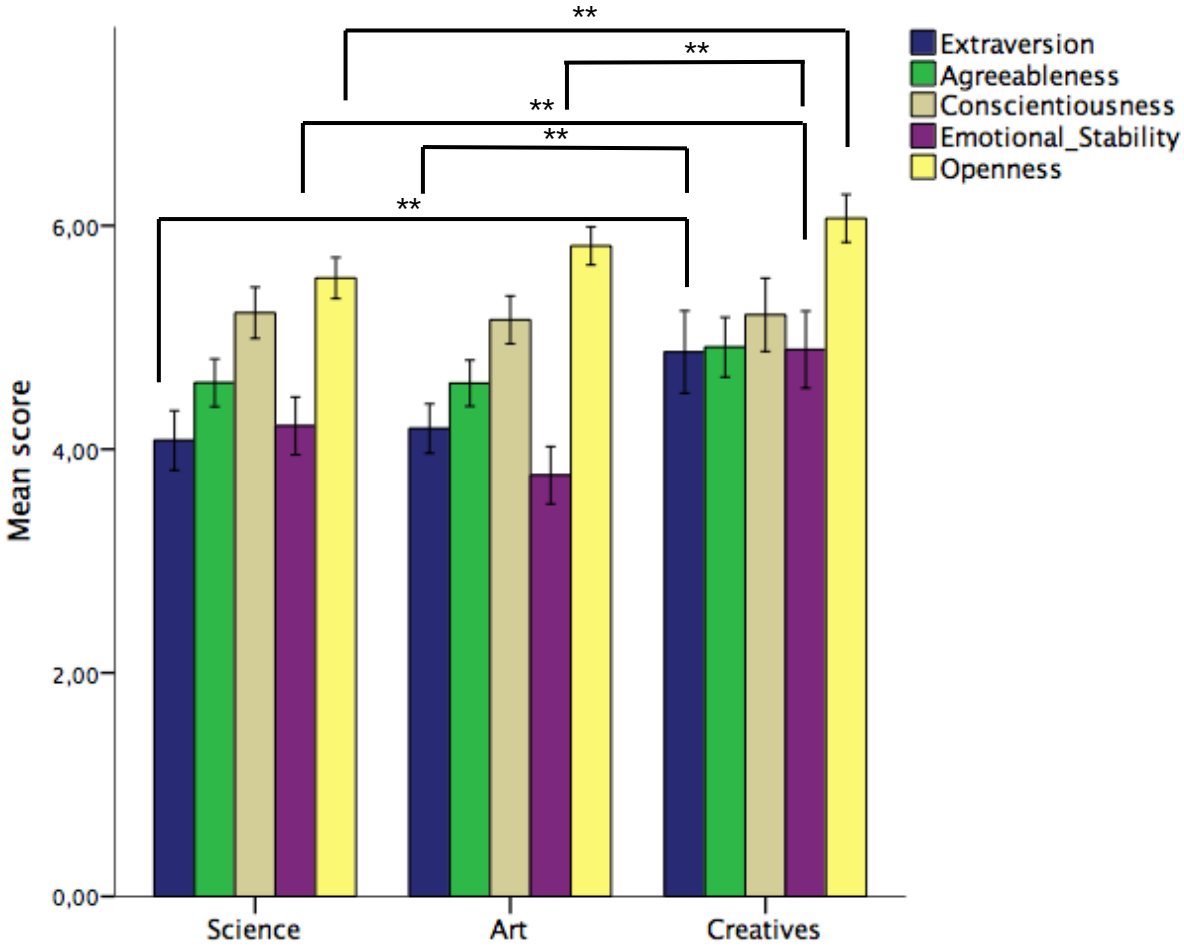

Figure 4. Big 5 personality traits in the scientific, artistic and creative industry domains. Significant differences in the personality traits between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$). Please refer to the text for more information on the significant differences within each domain.

were used to analyse the significant results emerging from univariate analyses. This analysis shows that personality is significantly different in the three knowledge domains, $F(10,634)=5,32$, $p<.001$, $\eta^2_p=.078$ (see Figure 4). In particular, univariate analyses show that this difference is significant in three personality traits, Extraversion, $F(2,322)=7.46$, $p=.001$, $\eta^2_p=.045$, Emotional stability, $F(2,322)=13.30$, $p<.001$, $\eta^2_p=.077$, and Openness, $F(2,322)=6.95$, $p=.001$, $\eta^2_p=.042$. More specifically, post-hoc analyses reveal that creative professionals are characterized by higher levels of Extraversion than science students and art students (ps=.001). Moreover, creative professionals are characterized by higher levels of Emotional Stability than science and art students ($p=.006$ and $p<.001$, respectively). Finally, creative professionals exhibit higher Openness levels than science students ($p=.001$), but not than art students. These results seem to highlight that science and art students are characterized by a similar personality structure. At the same time, science students differ from creative professionals in several personality traits, Extraversion, Emotional Stability, and Openness, highlighting that science and creative industry knowledge domains are characterized by different personalities. Moreover, results show that creative professionals are characterized by a personality structure hat is not highly different from the art students' personality. Creative professionals and art students differ only in the Emotional stability trait, highlighting that professionals are more emotionally stable and more resistant to stress than students. Summarizing, these results showed that the stereotypical difference in personality between science and art domain is not present in university students: their personality structure is essentially identical. On the other hand, the more equilibrate personality structure in creative professionals could be ascribed to the higher mean age of the creative industry sample, which could enhance and crystallize some personality dimensions (in particular Openness) typical of the artistic domain.

A second order of analyses explores the differences in the motivational tendencies between the three knowledge domains (Figure 5). The MANOVA shows that differences in the motivational tendencies across the three domains exist, $F(4,636)=4.29$, $p=.002$, $\eta^2_p=.026$. In particular univariate analyses highlight that this difference is significant only in the tendency to be intrinsically motivated, $F(2,320)=7.28$, $p=.001$, $\eta^2_p=.044$, while the three domains are characterized by a similar level of extrinsic motivation (see Figure 7). The post-hoc analyses showed in particular that creative professionals are characterized by a higher level of intrinsic motivation than science students ($p=.001$) and art students ($p=.004$). This result highlighted that the creative work require a high level of intrinsic motivation to be done. In comparison to students, creative professionals have indeed a high tendency to be intrinsically motivated. Further analyses must explore if this tendency effects the creative achievement in the three domains. Regarding the effects emerged from the analyses of personality traits, again these results show that science and art students do not differ as per the personal individual tendencies.

A final further analysis demonstrates that in all domains the intrinsic motivational attitude is higher than the extrinsic motivation attitude (ps<.001).

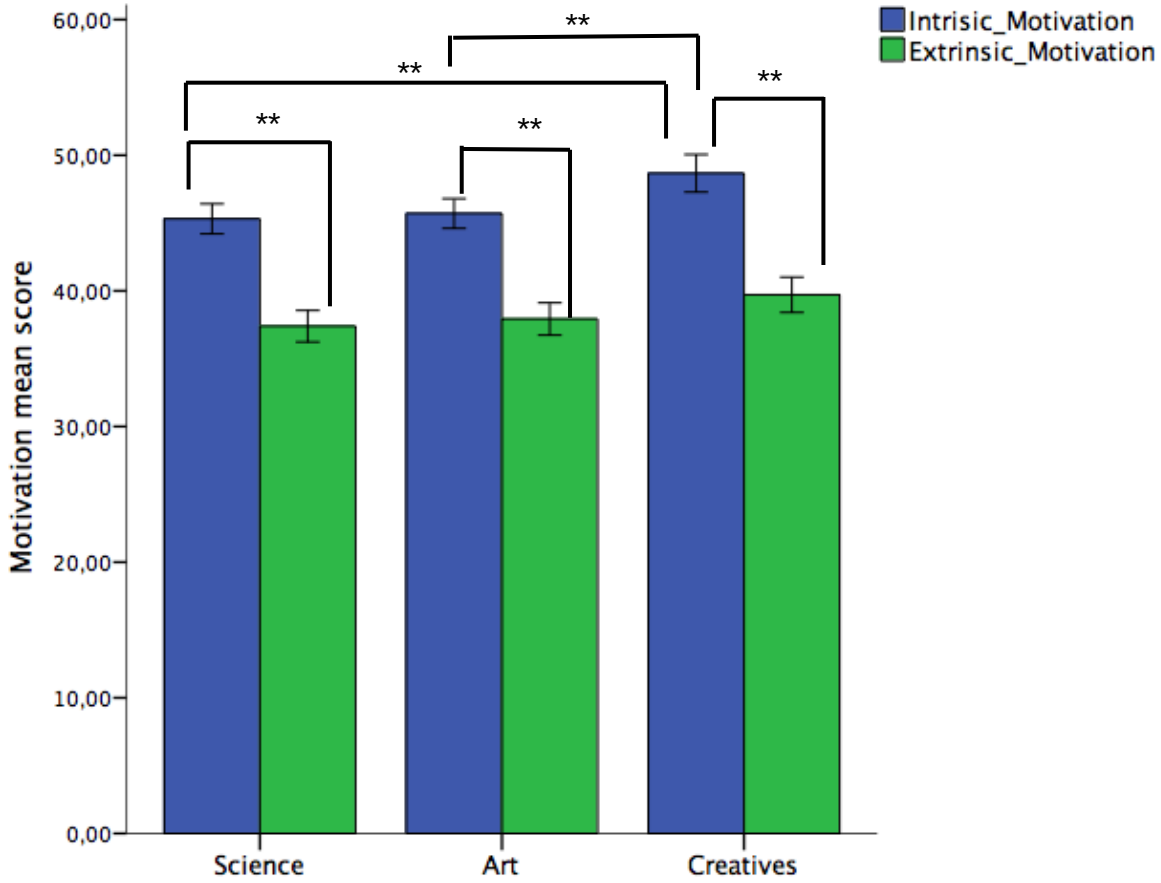

Figure 5. Intrinsic and extrinsic motivation in the scientific, artistic and creative industry domains. Significant differences in motivational tendencies both within and between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$).

A final analysis explores the differences in self-efficacy between the three domains. An univariate ANOVA, in particular, shows that self-efficacy is different in the three domains, $F(2,322)=24.76$, $p<.001$, $\eta^2_p=.134$. Post-hoc analyses specifically demonstrate that self-efficacy in the creative industry domain is higher than in the scientific ($p<.001$) and in artistic ($p<.001$) domains (see Figure 6). This result shows that while in the scientific and artistic domains self-efficacy is similar, in the creative industry domain it is significantly higher. This effect could be imputed to the different expertise of creative professionals compared with science and art students. The creative professionals involved at the Engine Group are indeed all reknown and appreciated professionals; the different expertise level could therefore explain the differences in self-efficacy between the three explored domains. Once again this results testify that science and art students do not differ in the personal individual differences.

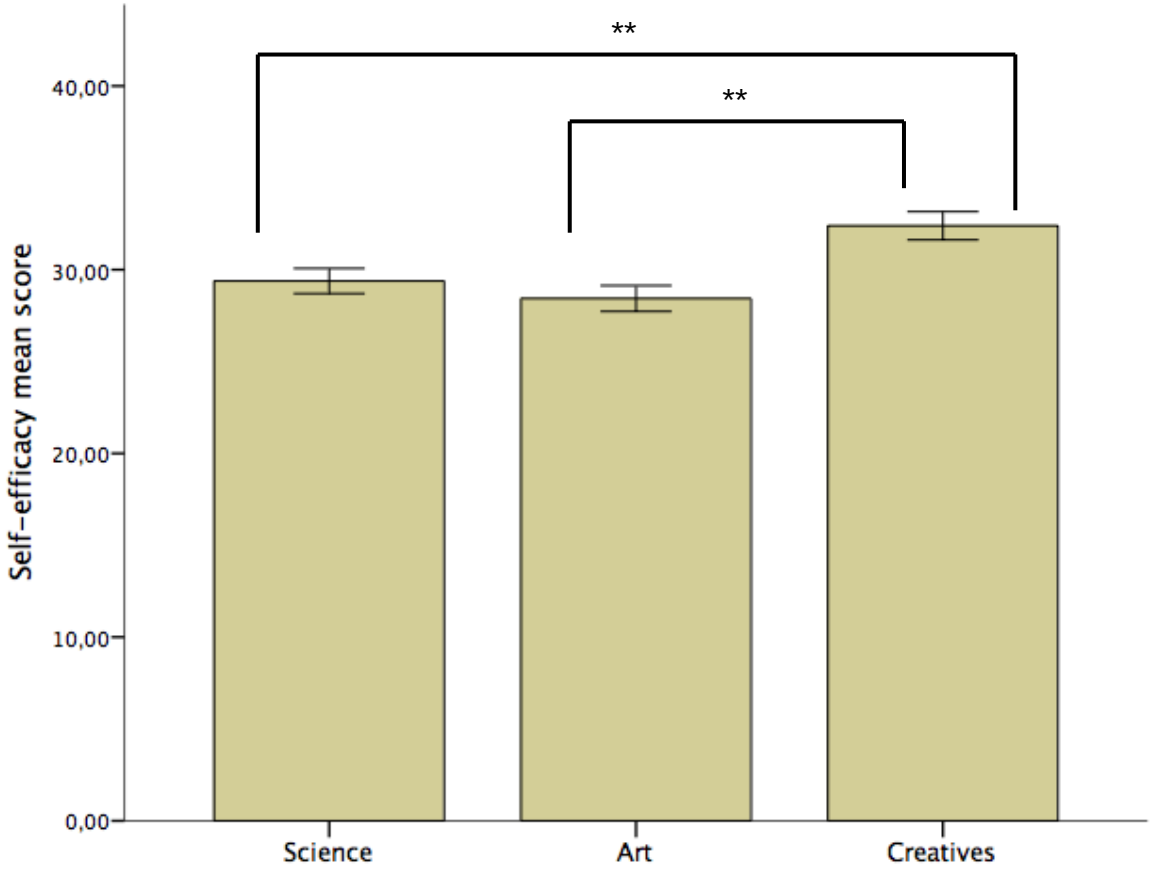

Figure 6. Self-efficacy scores in the scientific, artistic and creative industry domains. Significant differences in self-efficacy between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$).

7.2. Science vs. Art vs. Creative domains: intelligence

A second analysis explores the differences between the three domains in intelligence, as measured through the Raven test (Figure 7). A univariate ANOVA demonstrates that a difference in intelligence exists between the three domains, $F(2,322)=18.90$, $p<.001$, $\eta^2_p=.106$. Post hoc analyses in particular show that scientific domain is characterized by a higher intelligence level than both artistic ($p<.001$) and creative industry ($p<.001$) domain, while artistic and creative industry domain are characterized by similar intelligence level. Consistently with the results of the previous section highlighting that higher intelligence is associated with a higher scientific creative achievement, these results seem confirming that the scientific domain is characterized by higher cognitive abilities in comparison with the other two domains. This result moreover demonstrates that, in comparison to the personality tendencies, cognitive abilities differ in science and art students, testifying that the scientific domain requires more than the artistic (and advertisement professional domain) both the eductive ability (the ability to generate high level schemata which can allow for an easier handling of complexity) and the reproductive ability (the ability to absorb, recall, and reproduce information) measured through the Raven test.

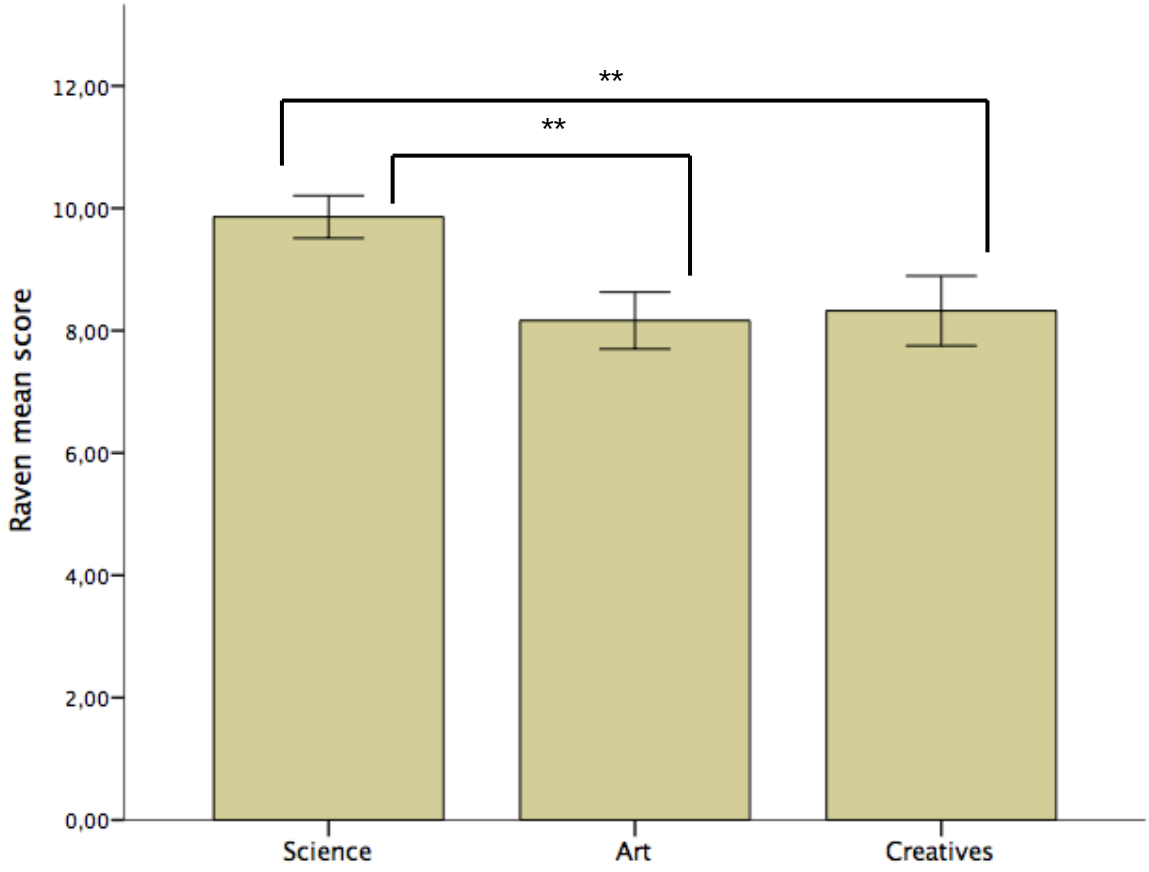

Figure 7. Intelligence, as measured through the Raven test, in the scientific, artistic and creative industry domains. Significant differences in Raven test scores between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$).

7.3. Science vs. Art vs. Creative domains: creative abilities

In this section the differences and similarities in creative abilities between the three domains are explored. First, the analyses on the convergent tasks (RAT and insight problems) are reported, then the analyses on divergent thinking abilities (fluency and originality) in the three tasks (Figures, Realistic Problems, and Titles) are exposed, and finally the analysis on assessment ability (Judgment task) is presented.

Starting from the analyses on convergent thinking, a first univariate ANOVA highlights significant differences in RAT scores between the three domains, $F(2,313)=4.46$, $p=.012$, $\eta^2_p=.028$ (Figure 8). Post hoc analyses in particular reveal that the scientific domain reached higher RAT scores than the creative industry domain ($p=.018$). This result should be further explored, since from the one side it could be determined by cultural differences between the scientific sample (mostly Italian students) and the creative sample (British creative professionals), and, from the other side, it could be determined by the task requirements of RAT, that it is associated with intelligence. Since no significant differences between creative professionals and art students emerged, the second hypothesis is more plausible, tracing the difference emerged in the artistic and creative domain to the characteristics of the RAT task.

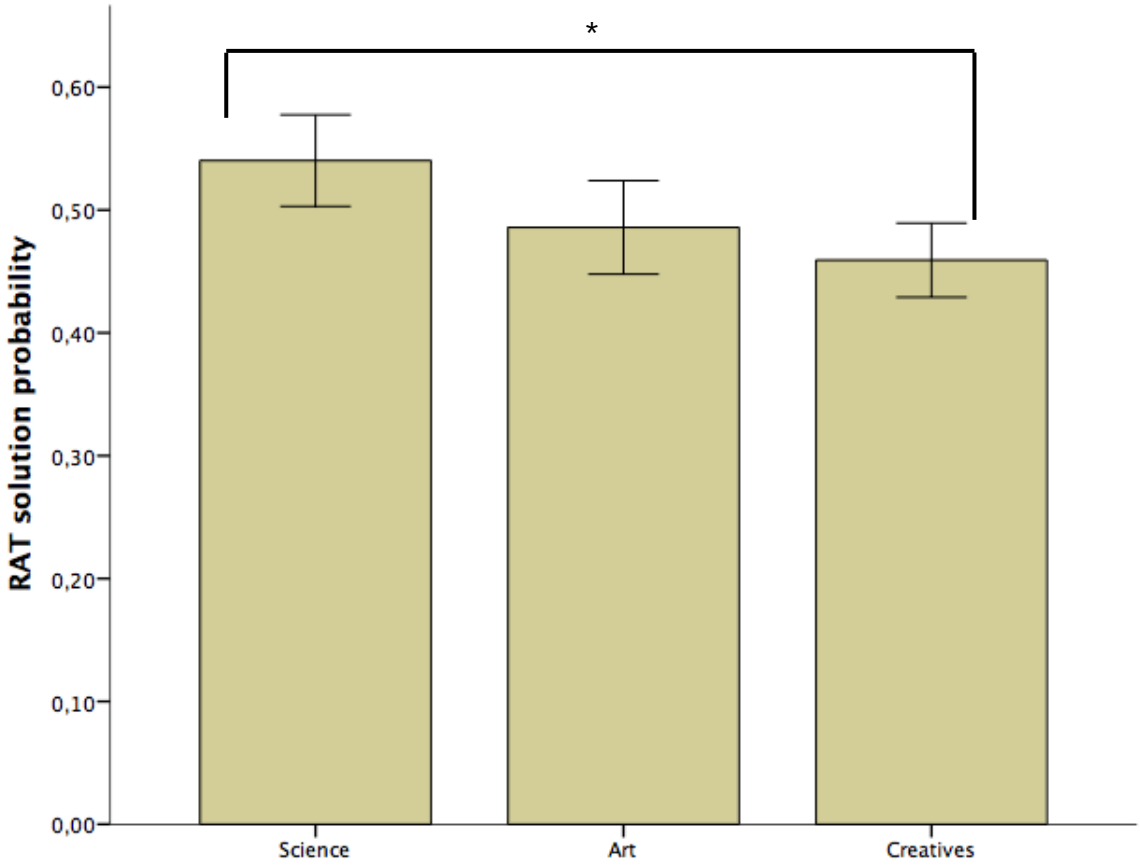

Figure 8. RAT probability of solution (from 0 to 1, corresponding to the 0% and to the 100% of solutions, respectively) in the scientific, artistic and creative industry domains. Significant differences between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$).

A second analysis explored differences and similarities in insight problems solutions in the three domains. The univariate ANOVA analysis, with the probability of solutions in the three insight problems as dependent variable, shows a significant difference in the solution probability in the three domains, $F(2,323)=28.57$, $p<.001$, $\eta^2_p=.151$ (Figure 9). Post-hoc analyses show that science students are characterized by a higher percentage of solution in the insight problems than art students ($p<.001$) and creative professionals ($p=.040$), who show a higher solution percentage than the art students ($p<.001$). This result confirms the model emerged from the preliminary analysis, that showed that insight defined convergent thinking modality, which best predicted scientific creative achievement. Art students showed the lowest probability of solution in insight problems. Since creative professionals are characterized by tendencies and abilities very similar to art students, we could hypothesise that the ability of finding a solution by insight could increase with age (even if it remains lower than in the scientific domain).

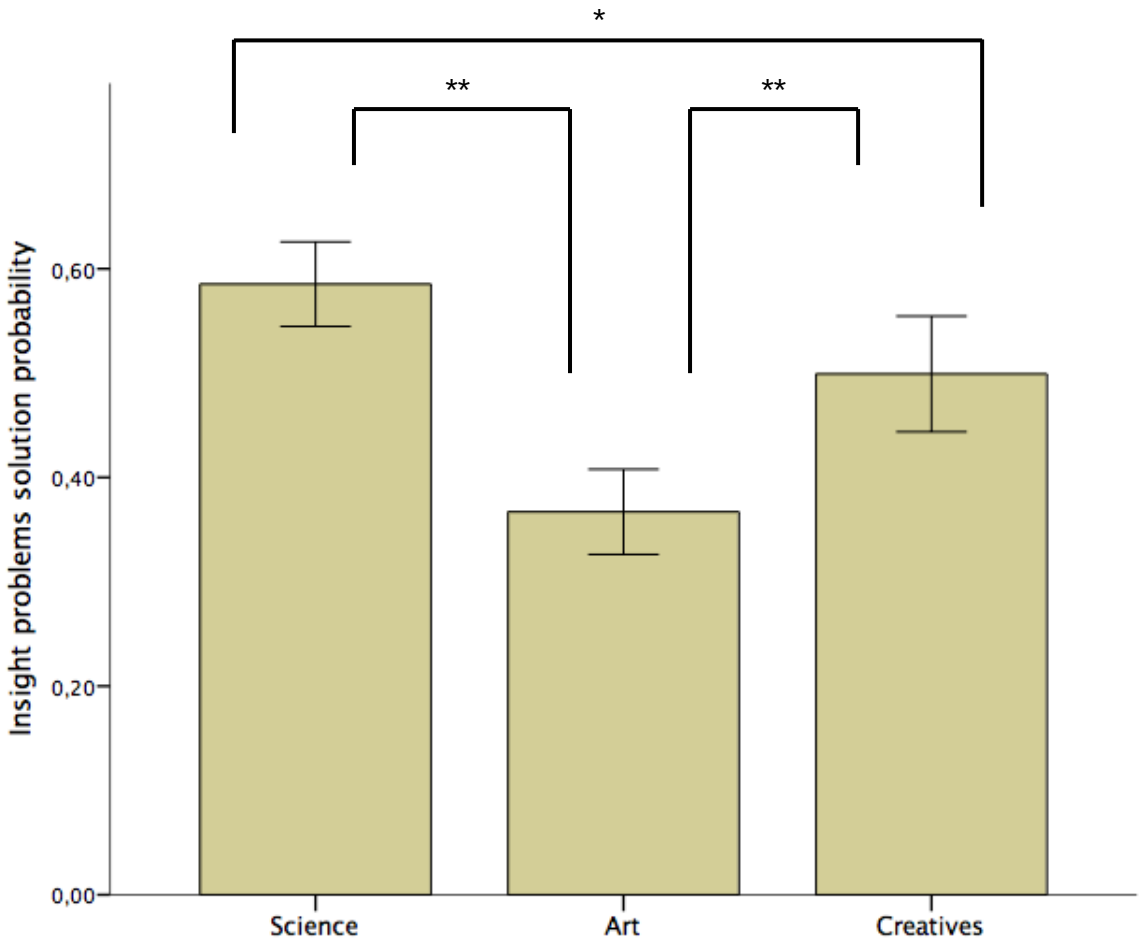

Figure 9. Insight problems probability of solution (from 0 to 1, corresponding to the 0% and to the 100% of solutions, respectively) in the scientific, artistic and creative industry domains. Significant differences in insight problems solutions between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$).

A second series of analyses explore the divergent thinking abilities differences in the three domains. Starting with the analysis of the fluency scores in the three divergent tasks (Figure 10), a MANOVA analysis highlighted as fluency is significantly different in the three domains, $F(6,598)=20.51$, $p<.001$, $\eta^2_p=.171$. Further univariate ANOVAs show that this difference in the production of solutions is significant in the Figures task, $F(2,302)=33.54$, $p<.001$, $\eta^2_p=.183$, in the Realistic Problems task, $F(2,302)=73.41$, $p<.001$, $\eta^2_p=.329$, and in the Titles task, $F(2,302)=22.40$, $p<.001$, $\eta^2_p=.130$. While scientific and artistic domains do not differ in fluency, creative professionals outperform scientific and artistic performance in all three tasks, always showing a significant higher production fluency (ps <.001). These results show that while art and science students are characterized by a similar solutions fluency in the divergent tasks, creative professionals are characterized by a significantly higher fluency ability than the other two tested samples, probability due to the higher expertise and to the nature of the creative professionals' work, that is strictly concerned with the production of always new alternatives.

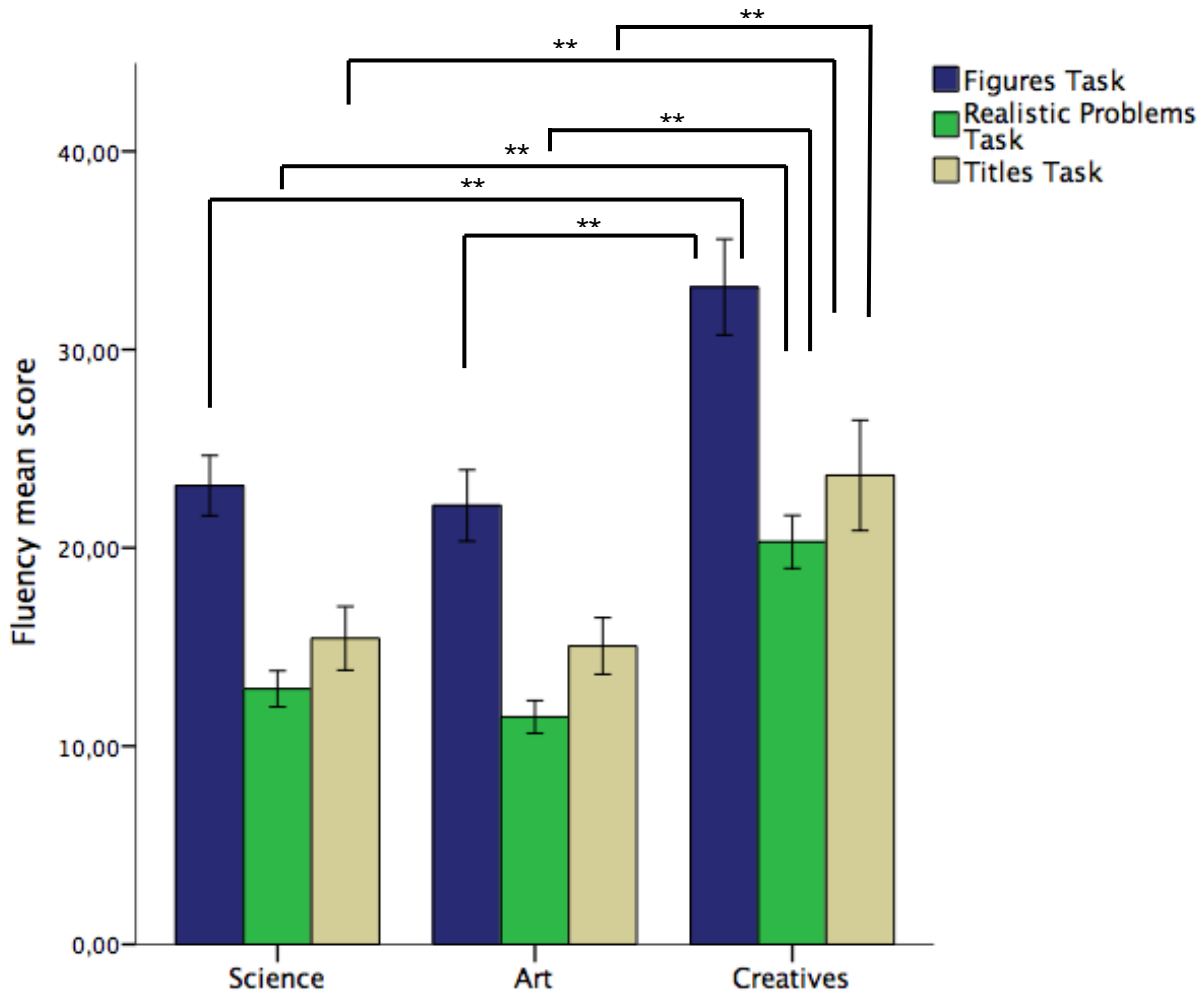

Figure 10. Fluency of produced solutions in the three divergent tasks (Figures, Realistic Problems, Titles) in the scientific, artistic and creative industry domains. Significant differences in divergent tasks fluency between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$).

Moreover, repeated-measures ANOVAs separately executed in the three domains highlight differences in fluency across the three tasks both in the scientific domain, $F(2,234)=150.24$, $p<.001$, $\eta^2_p=.562$, in the artistic domain, $F(2,234)=95.79$, $p<.001$, $\eta^2_p=.450$, and in the creative industry domain, $F(2,132)=70.47$, $p<.001$, $\eta^2_p=.516$. In all three domains the higher fluency is obtained in the Figures task and the lowest in the Realistic problems task (Figure 10). This result highlights the differences between the three divergent tasks, with the Figures task presenting less constraints and allowing a higher possibility to produce alternative responses, and the Realistic problems task characterized by a higher level of constraints (finding solutions for real problems), which limits the possibility to fluently produce alternative responses.

A further analysis concerns the exploration of the originality scores in the three divergent tasks across the three domains (see Figure 11). A MANOVA analysis highlighted that originality is significantly different in the three domains, $F(6,594)=9.64$, $p<.001$, $\eta^2_p=.089$. Univariate ANOVAs showed that this difference is significant in the Figures task, $F(2,300)=9.44$, $p<.001$, $\eta^2_p=.060$, in the Realistic problems task, $F(2,300)=21.10$, $p<.001$, $\eta^2_p=.124$, and in the Titles task, $F(2,300)=19.66$, $p<.001$,

η^2_p=.117. Moreover, post-hoc analyses show that only slight differences emerged between scientific and artistic domains in the originality of alternatives produced in the divergent tasks. In particular, the science student were characterized by a higher level of originality in the alternatives produced in the Realistic problems task than the art students (p=.009). However, post-hoc analyses also highlighted that creative professionals were characterized by a better performance in originality in all three divergent tasks that the than science and art students (ps<.001). These analyses therefore suggest that scientific and artistic domains are characterized by a similar performance in originality in divergent tasks, while creative professionals outperform their performance. Similarly to the results emerged in the personality traits, these results suggest that science and art students do not differ in basic abilities (as divergent thinking abilities are) usually demonstrated to be related to creativity. On the contrary, advertisement professionals are characterized by a higher level of creative abilities that students.

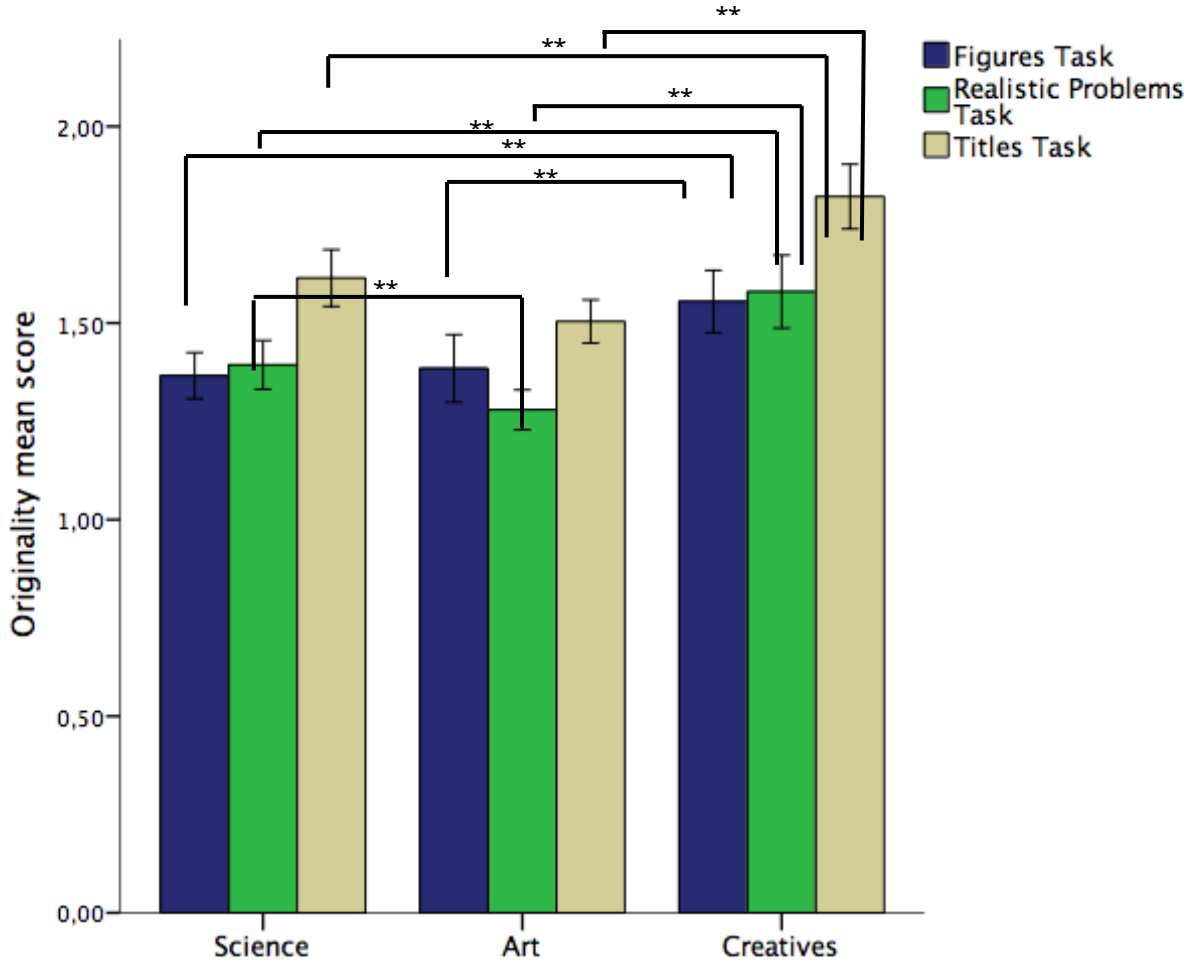

Figure 11. Originality of produced solutions in the three divergent tasks (Figures, Realistic Problems, Titles) in the scientific, artistic and creative industry domains. Significant differences in divergent tasks originality between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$).

Repeated-measures ANOVAs separately executed in the three domains highlight differences in the originality of alternatives across the three tasks in the scientific, $F(2,230)=37.19$, $p<.001$, $\eta^2_p=.244$, in the artistic, $F(2,234)=26.80$, $p<.001$, $\eta^2_p=.186$, and in the creative industry domain, $F(2,132)=18.26$, $p<.001$, $\eta^2_p=.217$. In all three domains the highest originality scores were obtained in the Titles task (Figure 11). This task was indeed created to arouse originality in the production of alternatives, since it stimulates the production of alternatives starting from a reference norm from which the produced alternatives must differ. The role of this task on the creative achievement will be further explored with more specific analyses.

A final analysis explores the differences in the assessment ability between the three domains (Figure 12). The univariate ANOVA shows a significant difference in the assessment ability between the three domains, $F(2,323)=9.86$, $p<.001$, $\eta^2_p=.058$. Post-hoc analyses do not show significant differences between creative professionals and art students, but a slight difference between science and art students ($p=.050$), and a significant difference between creative professionals and science students ($p<.001$) emerged. This result shows that creative industry and artistic domains do not differ in their assessment ability, but, on the contrary, that creative professionals are more able to evaluate than science students. In particular, creative professionals are more able to assess a creative product accordingly to the norm; this ability is essential also in the artistic domain that could develop this ability in comparison to the scientific domain, which could instead have less need for such ability. In the scientific domain indeed finding the correct solution does not usually need an assessment stage, as it autonomously emerged as the best solution.

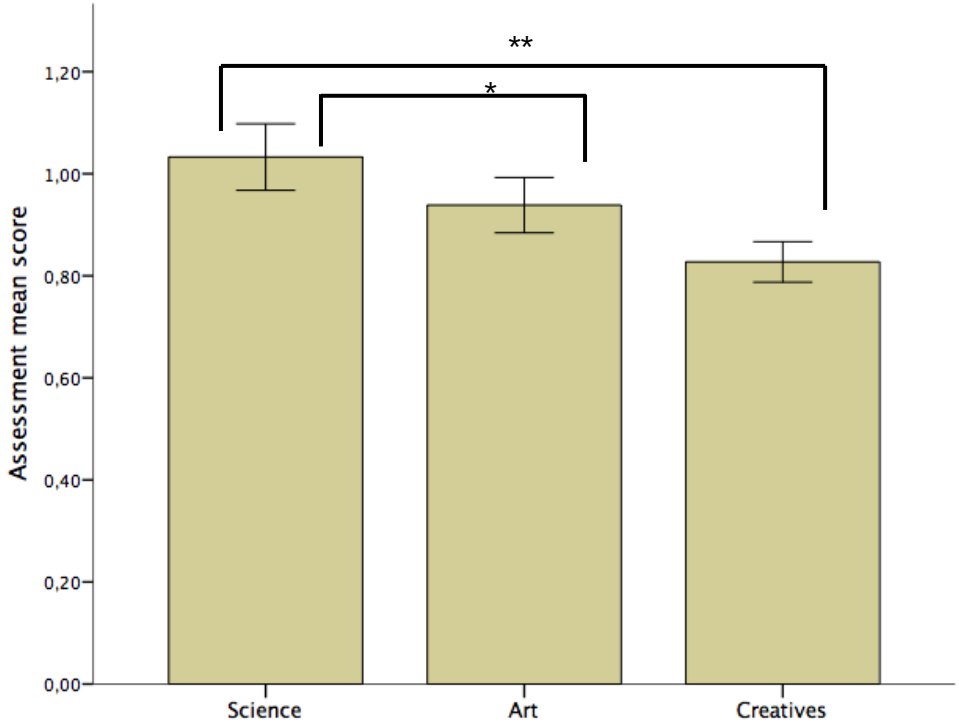

Figure 12. Mean assessment scores (0 means a total correspondence with the norm, i.e., the assessment provided by expert raters) in the scientific, artistic and creative industry domains. Significant differences in the assessment ability between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$).

7.4. Science vs. Art vs. Creative domains: creative achievement

The final analyses of this section explored the differences in the creative achievement between and within the three explored domains. A MANOVA analysis with the scores of the three subscales of CAAC as dependent variables shows that differences in creative achievements between the three domains exist, $F(6,638)=25.62$, $p<.001$, $\eta^2_p=.194$. In particular, univariate analyses reveal that these differences are significant in the scientific achievement, $F(2,322)=36.66$, $p<.001$, $\eta^2_p=.186$, in the artistic creative achievement, $F(2,322)=29.58$, $p<.001$, $\eta^2_p=.156$, and in the everyday creative achievement, $F(2,322)=8.04$, $p<.001$, $\eta^2_p=.048$ (Figure 13). Post-hoc analyses show that scientific creative achievement is higher in science students than in art students ($p<.001$) and in creative professionals ($p<.001$); on the contrary, art students do not differ in the scientific creative achievement from creative professionals. This result could in part be related to the different demands of the environments where science students operate in comparison to the environment of art students and creative professionals; while science students in university mainly process scientific subjects, art students and creative professionals within their environments mainly face artistic issues. This result could suggest that creative professionals and art students could not be considered good representatives for the analysis of scientific creative achievement.

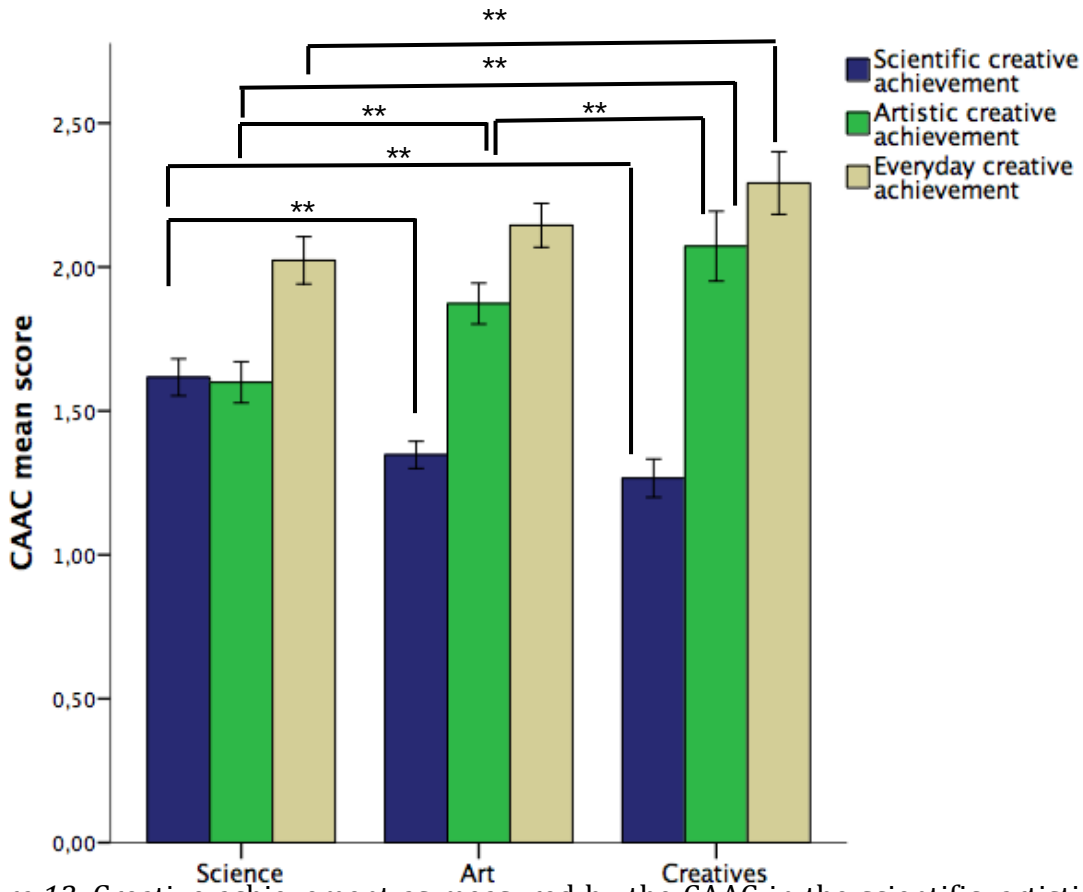

Figure 13. Creative achievement as measured by the CAAC in the scientific, artistic and creative industry domains. Significant differences in creative achievement between the three domains are depicted in the Figure (** $\alpha \leq 0.01$; * $\alpha \leq 0.05$).

As per artistic creative achievement, art students show a higher achievement than science students ($p<.001$). In the same way, creative professionals show a higher artistic creative achievement than science students ($p<.001$), and, even if to a lesser extent, than art students ($p=.006$). On the basis of this result, science students will be excluded from the analysis of the predictors of artistic creative achievement, which will be explored in particular in art students (see section 8.2).

Finally, everyday creative achievement do not show differences between science and art students who were characterized by a similar everyday achievement level, nor between art students and creative professionals, who again emerged as characterized by similar characteristics. However, the post-hoc analyses show that creative professionals were characterized by a higher everyday creative achievement than science students ($p<.001$). Different from other creative achievements, in everyday creative achievement less differences emerged between the three domains, even if the higher expertise and age of creative professionals could have influenced the higher everyday creative achievement.

Finally, repeated-measures ANOVAs were conducted separately for the three domains. In the three domains, differences in the achievement measured in the three subscales emerged (Scientific domain: $F(2,252)=105.89$, $p<.001$, $\eta^2_p=.457$; artistic domain: $F(2,252)=250.57$, $p<.001$, $\eta^2_p=.665$; creative industry domain: $F(2,136)=207.87$, $p<.001$, $\eta^2_p=.754$). In all three domains everyday creative achievement presents in particular higher scores. All three domains are therefore characterized by a high creative achievement in the everyday life. This result suggests including all three domains in the analysis of the predictors of everyday creative achievement, exploring in particular whether the different domain could influence the level of creative achievement if controlled for the other variables.

8. Predictors of creative achievement in different knowledge domains

The previous analyses described some clear trends in the associations between the variables included in the CREAM test battery, which mainly confirm the data present in literature and the data trends emerged from the first set of analyses performed at the end of the first period of the project. The main purpose of these analyses was to understand how the creative abilities (convergent and divergent) were associated between them and with personality and cognitive variables, and finally with creative achievement in different domains. Moreover, the analyses aimed at understanding how creative abilities, personality traits and tendencies, and intelligence were distributed within each domain (scientific, artistic, and professional) and the main differences in these variables between the three domains.

A first clear trend highlighted that convergent abilities (associative ability measured by RAT and insight measured by insight problems) were associated between them and with the cognitive abilities measured by the Raven intelligence test. Confirming the model emerged from the preliminary analysis (see section 3), only insight was associated to creative achievement, and in particular with scientific creative achievement, and not with artistic and everyday creative achievement. Moreover, insight problems solution probability was the main variable distinguishing science and art students. Divergent thinking abilities were instead highly associated with personality traits (extraversion and Openness) and tendencies (intrinsic motivation) and with artistic and everyday creative achievement (in particular the originality scores of the Titles task). Moreover, the analyses on the differences between the three explored domains (science students, art students, and creative professionals) showed clear trends: science and art students are characterized by similar personality structure, while creative professionals show higher level of Emotional stability and Extraversion than the other domains. However, creative professionals show a personality structure more similar to art students than to science students, in particular in Openness, a personality trait highly related to the artistic and everyday creative achievement. We could hypothesise that creative professionals, characterized by an older age than the students' samples, could have increased and crystallized some personality traits essential for their profession. Science students, however, were characterized by higher intelligence level than art students and creative professional. We could associate this result to the demands of the scientific environment, where the typical cognitive abilities measured by the Raven test are highly requested and awarded.

Finally, a difference in creative achievement in different domains between the three samples clearly emerged. Science students are characterized by a higher scientific creative achievement than art students and creative professionals. Art students and creative professionals are characterized by a higher artistic creative achievement than science students. Finally, all three samples were characterized by a high level of everyday creative achievement, with creative professionals showing the highest level. On the basis of these results we decided to more specifically explore the main predictors of the scientific creative achievement in the sample composed by science students, which represented a better representative of this domain than the other two samples. In order to have a good comparison with the data obtained in the scientific domain, we

decided to explore the main predictors of artistic creative achievement only in the sample of art students; they are indeed comparable in age, in language, and in number to the science students, and can be considered good representatives of the artistic domain. Finally, since all three samples were characterized by a high level of everyday creative achievement, we explored this achievement form on the entire sample, taking particular care in exploring age and domain influences.

8.1. Scientific creative achievement

A series of regression models have been performed in order to explore the main predictors of scientific creative achievement. This approach allowed understanding the weight of the single variables in the prediction of creative achievement. To this purpose we run hierarchical regression models, introducing in different steps the different variables. With such an approach, we intend to explore the role of the creative abilities in the scientific creative achievement controlling for the effect of some basic variables as age, gender, personality traits and attitudes, and intelligence. In the case the main effect of a creative variable emerging from the regression model contrasted with the data trends emerged from the previous analyses, more specific interaction analyses (and particularly moderation analyses) have been performed, in order to understand whether the main effect in the hierarchical model could have been determined by an interaction with a control variable.

8.1.1. Scientific sample: science students

The scientific sample is composed by 126 students from scientific departments of the University of Bologna. Their mean age is 24.02 (*SD*=3.03), they are 83 males and 43 females. For more details on the sample please refer to section 5.1.

8.1.2. Results and discussion

A hierarchical regression model has been performed, hierarchically organizing the variables measured through the CREAM test battery (Table 17). In the first blocks the control variables have been introduced, starting (step 1) with the gender and age of the participants, followed by the Big 5 traits (step 2) and the motivation and self-efficacy individual tendencies (step 3), and ending with the general cognitive abilities (step 4). In the following blocks, the creative abilities have been introduced; since the previous analyses demonstrated that the divergent, convergent, and assessment abilities are distinct variables, we introduced them in different blocks (divergent abilities in step 5, convergent abilities in step 6, assessment ability in step 7)[1].

The model (looking a the last significant block) predicted a significant portion of the variance (Adjusted R^2 = .29) of the scientific creative achievement (Table 17). Three blocks in particular determined a significant change in the model, and in particular the

[1] We ran regression models with a different order of creative abilities, introducing for example first the convergent abilities prior to the divergent abilities. However, since they are clearly distinct variables the effects and the results did not change.

Table 17. Hierarchical multiple regression on scientific creative achievement scores.

	Scientific Creative Achievement						
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Gender	0.03	0.06	-0.02	-0.02	0.01	-0.01	-0.01
Age	0.29**	0.25**	0.29**	0.29**	0.29**	0.26**	0.26**
Extraversion		0.10	0.14	0.13	0.06	0.03	0.03
Agreeableness		-0.07	-0.10	-0.10	-0.13	-0.12	-0.12
Conscientiousness		-0.04	0.01	0.01	-0.03	-0.02	-0.02
Openness		0.14	0.02	0.02	0.02	-0.01	-0.01
Emotional stability		0.15	-0.03	-0.04	-0.03	-0.04	-0.04
Intrinsic Motivation			0.19	0.19	0.17	0.26*	0.26*
Extrinsic Motivation			-0.06	-0.06	-0.06	-0.08	-0.09
Self efficacy			0.33**	0.33**	0.33**	0.33**	0.33**
Intelligence				-0.16	0.01	0.05	0.05
Figures Fluency					-0.25	-0.23	-0.24
Real Problem Fluency					0.10	0.12	0.12
Titles Fluency					0.33*	0.35*	0.35*
Figures Originality					0.15	0.15	0.15
Real problem Originality					-0.09	-0.13	-0.12
Titles Originality					-0.04	-0.09	-0.09
RAT						-0.35**	-0.36**
Insight problems						0.15	0.15
Assessment							-0.02
R^2	0.06	0.07	0.20	0.19	0.22	0.29	0.28
ΔR^2	0.06	0.01	0.13	0.01	0.03	0.07	0.01
F	4.99**	2.26*	3.80**	3.42**	2.91**	3.38**	3.18**
ΔF	4.99**	1.15	6.55**	0.03	1.70	5.21**	0.02
df	109	104	101	100	94	92	91

Notes: Step 1: Gender, Age; Step 2: Extraversion, Agreeableness, Conscientiousness, Openness, Emotional stability; Step 3: Intrinsic motivation, Extrinsic motivation, Self efficacy; Step 4: Intelligence; Step 5: Figures fluency, Realistic problems fluency, Titles Fluency, Figures originality, Realistic problems originality, Titles originality; Step 6: RAT, Insight problems; Step 7: Assessment. Numbers in the first seven rows represent standardized regression coefficients; * $p < .05$, ** $p < .01$

block containing age, the block with the personality tendencies (and in particular self-assessment) and the block containing problem solving and in particular the RAT scores.

The main predictors of scientific creative achievement are age, self-efficacy, and the RAT scores, the latter predicting negatively scientific creative achievement. In particular, an increase of age positively predicted the increase of scientific creative achievement. This result could be associated to the measurement of creative achievement provided by CAAC, which measures the achievement on the basis of how frequently the participants performed specific scientific activities related to scientific achievement. The increase of age could determine a higher frequency in those activities. The best predictor of scientific creative achievement resulted self-efficacy, which produced the highest change in R^2 when introduced in the model (see Table 17). Self-efficacy is related to the personal belief to being able to control a challenging environment by means of taking adaptive action (Schwarzer et al., 1997). This personal belief resulted to be highly important for the scientific creative achievement, which requires a high perseverance in managing complex problems to not give up in front of many difficulties. Moreover, the associative ability measured by the RAT task resulted to predict negatively the scientific creative achievement. This result emerged as a tendency also in the correlational analyses, even if it resulted significant only in the artistic and everyday creative achievement. This result seems testifying that a higher ability to remotely associate words is negatively associated to creative accomplishments in the scientific domains. This result should be further explored, in the attempt to understand the typology of associative abilities involved in the RAT task. Benedek et al. (2012) in particular showed that some associative abilities are related to creativity, but other associative abilities (as associative fluency and associative flexibility) are not related to creativity. A specific analysis on the role of associative abilities on scientific creativity should be performed, in order to understand the negative predictor role of the RAT associative abilities on scientific creative achievement. Moreover, in the CREAM test battery administration the RAT task was used accordingly to the literature. However, as recently demonstrated within the CREAM project (see for example Deliverable D3.1), RAT triplets can be solved both with the use of insight and without insight. A significant difference in the brain structures involved in the two forms of problem solving emerged, highlighting that the solutions by insight are associated to a network of areas including cortical and subcortical regions. In particular, on the basis of these results, we can hypothesise that the negative predictor role of RAT can be influenced by the mixed nature of this task. For this reason, we suggest in future research to distinguish between solutions reached through insight and solutions obtained without insight. This methodology could help in better understanding the use of RAT in the measuring of scientific creative achievement.

Moreover, two other results should be highlighted. Even if the entire block did not introduce a significant change in R^2, a single divergent ability emerged as significant predictor of scientific creative achievement: Titles fluency (Table 17). Titles, as highlighted by previous analyses, emerged to be the most sensitive divergent task. This results is totally plausible, since the ability to produce many alternative solutions could be considered an important ability also in the scientific domain, where the ability to formulate and simultaneously consider and test different alternatives or hypotheses is essential to clarify complex natural phenomena that need an explanation. A final consideration should be given to the lack of significant predictive power of insight. This result contrast with the results of previous analysis; both the preliminary SEM analysis

and the correlational and ANOVA analyses showed insight as central in explaining the scientific domain.

In order to understand the role of insight in scientific creative achievement, we performed a second regression analysis where the significant predictors emerged in the previous analyses were included in the model, as well as an interaction of insight with self-efficacy (Table 18). Both insight and self-efficacy emerged indeed in the previous analysis as variables positively associated with scientific creative achievement. However, since self-efficacy was introduced in a previous step in the regression model than insight, and resulted to be an important predictor of scientific creative achievement, we intended to explore whether its effect interacted with insight, masking the insight effect at some level. The regression model shown in Table 18 was significant and predicted a higher portion of variance of scientific creative achievement than the previous model. It confirmed the positive predictive effect of age, self-efficacy, and Titles task fluency, and only partially confirmed the negative predictive power of RAT scores; moreover, an interaction between insight and self-efficacy emerged. A simple slopes computation, exploring a moderation effect of problem solving on self-efficacy, showed that self efficacy predicted scientific creative achievement only at a low level ($ß$ = .05, SE = .01, p < .01), and medium level of insight ability ($ß$ = .03, SE = .01, p < .01), but not at high levels of the moderator ($ß$ = .01, SE = .01, p = .29). Figure 14 in particular show how at high level of insight ability the self-efficacy level is no more important in predicting the creative achievement. This result could testify that when a sufficient level of ability to find problems through insight is lacking, believing in one's capabilities is extremely important in predicting the creative achievement. On the contrary, when a person possesses sufficient insight ability, self-efficacy is no more an essential requirement. Self-efficacy however remains a central predictor of scientific creative achievement, since the highest scores in creative achievement are attained at high self-efficacy levels (independently from the insight ability; see also Figure 14).

Table 18. Regression analysis of the effect of age, self-efficacy, Titles task fluency, RAT scores, insight, and the interaction of self-efficacy and insight on the scientific creative achievement.

	Scientific creative achievement		
	β	*SE*	*t*
Age	.034	.009	3.66***
Self-efficacy	.082	.020	3.99***
Titles fluency	.007	.003	2.18**
RAT	-.272	.168	-1.61*
Insight	2.768	.996	2.77***
Self-efficacy X Insight	- .087	.033	-2.60**
(Constant)	-1.735	.714	2.43**
$F(6,118) = 10.08$, $p < .001$ Adjusted $R^2 = .34$			

Notes: * $p < .10$; ** $p < .05$; *** $p < .01$

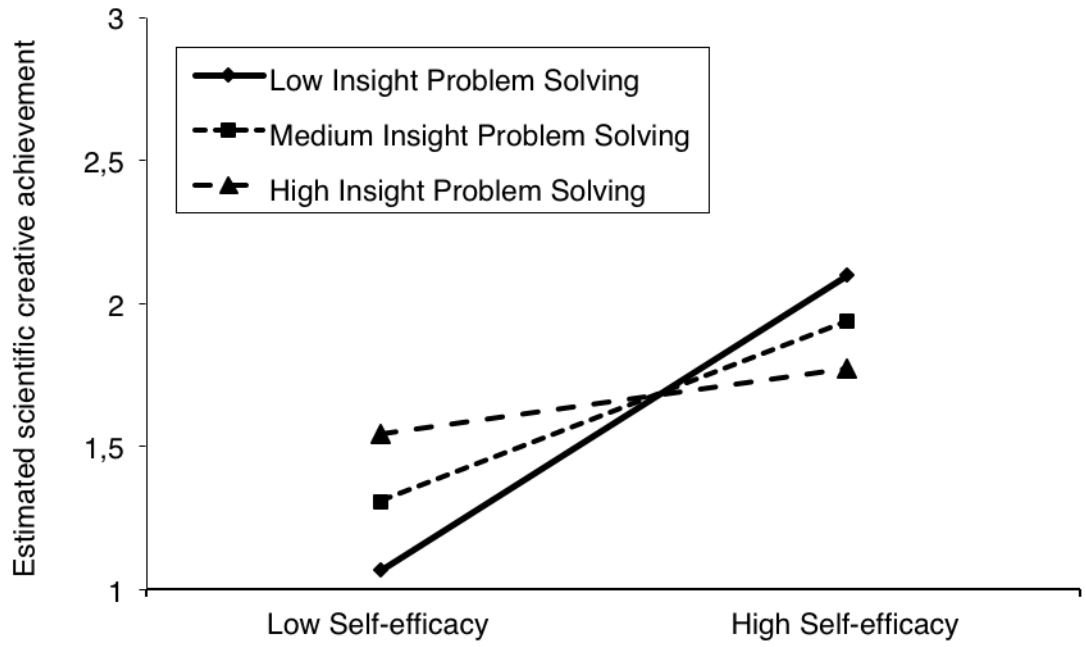

Figure 14. The moderator role of insight ability (low, medium, high) on the effect of self-efficacy (low, high level) on scientific creative achievement.

8.1.1. Conclusions

The analyses performed in order to understand the main predictors of scientific creative achievement show a clear pattern that partially confirmed the results emerged in the previous analyses. Personality traits and in general divergent abilities are not important predictors of scientific creative achievement. An exception is the positive predictive power of the fluency ability in the Titles task, which highlights the importance of the ability to produce different alternatives in thinking to a problem in the scientific domain. Moreover, a general tendency to negatively predict scientific creative achievement emerged in the RAT score. Even if this result emerged only as a tendency in the second regression model (Table 18), we will consider also the performance in the RAT task as (negative) predictor of creativity in the scientific domain. Self-efficacy emerged as the most important predictor of creative achievement in science. However, this variable interacted also with the ability to solve problems by insight in the prediction of creative achievement. Even if insight ability did not emerge as a significant predictor from the first analysis, a moderation analysis highlighted that it positively predicted scientific creative achievement, and that it interacted with self-efficacy in the explanation of achievement. This result suggests that a complex interaction between convergent ability and individual tendency must be considered to understand and predict scientific creative achievement.

8.2. Artistic creative achievement

The same approach used in the analysis of the predictors of scientific creative achievement was also used in the artistic domain. Starting from a hierarchical regression model, we extracted the main predictors of artistic creative achievement. These results were then joined with the results of the previous analyses in order to explore in a single regression model the main effects and the possible interaction effects between the variables emerged as the main determinants of artistic creative achievement.

8.2.1. The artistic sample: art students

The scientific sample is composed by 127 students from artistic departments of the University of Bologna. Their mean age was 23 (*SD*=5.27), they were 41 males and 87 females. For more details on the sample please refer to section 5.1.

8.2.2. Results and discussion

Following the analyses performed in the scientific domain, a hierarchical regression model has been performed, hierarchically organizing the variables measured through the CREAM test battery (Table 17). In the first blocks the control variables have been introduced, starting (step 1) with the gender and age of the participants, followed by the Big 5 traits (step 2) and the motivation and self-efficacy individual tendencies (step 3), and ending with the general cognitive abilities (step 4). In the following blocks, the creative abilities have been introduced; since the previous analyses demonstrated that the divergent, convergent, and assessment abilities are distinct variables, we introduced them in different blocks (divergent abilities in step 5, convergent abilities in step 6, assessment ability in step 7).

The model (considering the last significant block) predicted a significant portion of the variance (Adjusted R^2 = .15) of the artistic creative achievement (Table 19). Two blocks in particular determined a significant change in the model, and in particular the block

containing the personality traits and the block with the personality tendencies (and in particular self-assessment).

The main predictors of artistic creative achievement are Conscientiousness, which negatively predicted artistic creative achievement scores, Openness, and self-efficacy. These results highlighted that the main predictors of creative achievement in the artistic domain are essential related to the individual personality. First of all, artistic achievement can be predicted by low scores in Conscientiousness, that means that people less organized and conformist are more prone to obtain accomplishments in the artistic domain. This is one of the main personal characteristics described by Feist (1998) distinguishing artists from scientists. In particular a lower tendency to adhere to the norm and a higher tendency to the disorder can enhance the probability of artistic success. At the same time, higher Openness levels can predict creative achievement. This is one of the most stable effects in the study of creativity, repeatedly emerged in the study of the association between creativity and artistic creative achievement (e.g., Batey & Furnham, 2006; Feist, 1998). A higher open-mindedness allows a higher access to the information of the environment and a higher use of this information (Agnoli et al., 2015); this tendency has been demonstrated to be highly related to the creative achievement. Finally, as emerged in the scientific domain, self-efficacy, the personal belief to being able to control a challenging environment by means of taking adaptive action, emerged as a central predictor also in the artistic domain. The tendency to not give up in face of the inconclusiveness of the creative process, to believe in one's abilities is essential to achieve in the artistic domain.

Moreover, some other effect can be highlighted with a careful vision of the regression model. First of all, even if the entire block did not introduced a significant change in R^2, a single divergent ability emerged as significant predictor of artistic creative achievement: Figures fluency (Table 19). The fluency in the Figures tasks was significantly higher that the fluency scores in the other two divergent tasks (see Table 2). Figures task indeed, starting from abstract figures, intends to stimulate the highest production of alternative ideas. Even if the data demonstrate that a high productivity is not directly related to a high originality, the Figure task reaches its purpose, with a high production of alternative responses. The ability to produce alternatives without a clear reference (such as in the case of abstract figures) seems to be a good predictor of artistic creative achievement. Moreover, some final considerations should be provided in relation to the lack of significant predictive power of two measures: originality (in particular in the Titles Task) and assessment ability. These results indeed contrast with the results of previous analyses; both the preliminary SEM analysis and the correlational and ANOVA analyses showed indeed originality (and Titles Task originality) as central in explaining the artistic domain. Moreover, assessment resulted associated with artistic achievement. We could hypothesise that some variables previously introduced in the regression model could have masked the effect of these two variables.

Table 19. Hierarchical multiple regression on artistic creative achievement scores.

	Artistic Creative Achievement						
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Gender	-0.02	-0.04	0.00	-0.01	0.01	-0.02	-0.02

Age	0.01	-0.06	-0.02	-0.04	-0.02	-0.05	-0.05
Extraversion		0.12	0.09	0.10	-0.04	-0.04	-0.04
Agreeableness		0.05	0.08	0.07	0.09	0.08	0.07
Conscientiousness		-0.24*	-0.27**	-0.27**	-0.25*	-0.24*	-0.24*
Emotional stability		0.03	-0.01	0.00	0.01	0.01	0.02
Openness		0.24*	0.17	0.15	0.16	0.17	0.18
Intrinsic Motivation			-0.06	-0.06	-0.08	- 0.09	- 0.09
Extrinsic Motivation			-0.06	-0.06	0.04	0.05	0.04
Self efficacy			0.30**	0.32**	0.25*	0.26*	0.26*
Intelligence				-0.08	-0.08	-0.04	-0.04
Figures Fluency					0.29*	0.30*	-0.29*
Real Problem Fluency					0.10	0.12	0.12
Titles Fluency					-0.19	-0.21	-0.19
Figures Originality					0.17	0.19	0.19
Titles Originality					0.02	0.03	0.03
Real problem Originality					0.09	0.07	0.06
RAT						-0.01	0.02
Insight problems						-0.11	-0.10
Assessment							0.07
R^2	-0.02	0.10	0.15	0.15	0.19	0.19	0.18
ΔR^2	-0.02	0.10	0.05	0.01	0.04	0.00	0.01
F	0.03	2.72*	3.00**	2.78**	2.59**	2.34**	2.23**
ΔF	0.03	3.80**	3.24*	0.73	1.93	0.47	0.49
df	109	104	101	100	94	92	91

Notes: Step 1: Gender, Age; Step 2: Extraversion, Agreeableness, Conscientiousness, Openness, Emotional stability; Step 3: Intrinsic motivation, Extrinsic motivation, Self efficacy; Step 4: Intelligence; Step 5: Figures fluency, Realistic problems fluency, Titles Fluency, Figures originality, Realistic problems originality, Titles originality; Step 6: RAT, Insight problems; Step 7: Assessment. Numbers in the first seven rows represent standardized regression coefficients; * $p < .05$, ** $p < .01$

In order to understand also the role of Titles task originality and assessment on artistic creative achievement, we performed a second regression analysis where the significant predictors emerged in the previous analyses were included in the model as well as Titles task originality, assessment, and an interaction of originality with Openness. This interaction was introduced since it emerged as central in predicting creative achievement in previous research (e.g. Agnoli et al., 2015), highlighting a complex

association between originality and Openness. The regression model shown in Table 20 was significant and predicted a higher portion of variance of artistic creative achievement than the previous model (Adjusted R^2 = .31). It confirmed the positive predictive effect of Openness, self-efficacy, and Figures task fluency, and confirmed the negative predictive power of Conscientiousness; moreover, a significant positive effect of assessment, of response originality in the Titles task, and an interaction between originality with Openness emerged. As previously explained higher scores in the Judgment task mean a lower ability to assess accordingly to the norm (i.e., the originality rates of expert judges). The result in the Assessment ability therefore shows that a higher ability to assess in accordance with the norm negatively predicted artistic creative achievement. Accordingly to this result, higher accomplishments in the artistic domain can be obtained if a person is able to assess his/her own and others' products independently from the norm. This result is consistent with the Conscientiousness result, which suggests that less conformist people can reach a higher artistic creative achievement. Finally, the interaction effect emerged between originality and Openness was explored by a simple slopes computation. This analysis, exploring a moderation effect of Openness on Title task originality, showed that originality predicted artistic creative achievement only at a low level of Openness ($ß$ = .99, SE = .49, p < .05), but not at medium level ($ß$ = .24, SE = .41, p = .54), and at high levels of the moderator ($ß$ = -.49, SE = .58, p = .39). Figure 15 in particular shows that at low level of Openness the originality of response results important in predicting artistic creative achievement, with creative achievement increasing with the increase of the response originality. Even if the data trends seem reverse at medium and high levels of Openness, showing that response originality is detrimental to the artistic creative achievement at this level of the moderator, they did not result significant. These results could testify that the originality of response is extremely important when a personality structure is characterized by a low Openness level. In the case of low levels of Openness, the ability to produce original ideas results indeed fundamental to achieve accomplishment in the artistic domain. In the presence of medium and high levels of the Openness trait, instead, this ability looses its importance in predicting the achievement within this domain. The model shown in Table 20 presents therefore positive main effects of Titles originality and Openness, however the moderation analysis shows that the association between this fundamental creative ability and this personality trait is complex and that the two variables should be considered together in order to carefully understand their effect on artistic creative achievement.

Table 20. Regression analysis of the effect of Conscientiousness, Openness, self-efficacy, Figures task fluency, Titles task originality, assessment ability, and the interaction of Openness and Titles task originality on the artistic creative achievement.

	Artistic creative achievement		
	β	*SE*	*t*
Conscientiousness	-.106	.027	-3.94**
Openness	.176	.064	2.71**
Self-efficacy	.030	.009	3.29**
Figures fluency	.007	.004	2.16*
Titles originality	4.793	2.149	2.23*
Assessment	.279	.112	2.49*
Openness X Titles originality	- .783	.375	-2.08**
(Constant)	.075	.478	0.16
$F(7,110) = 7.06$, $p < .001$ Adjusted $R^2 = .31$			

Notes: * $p < .05$; ** $p < .01$

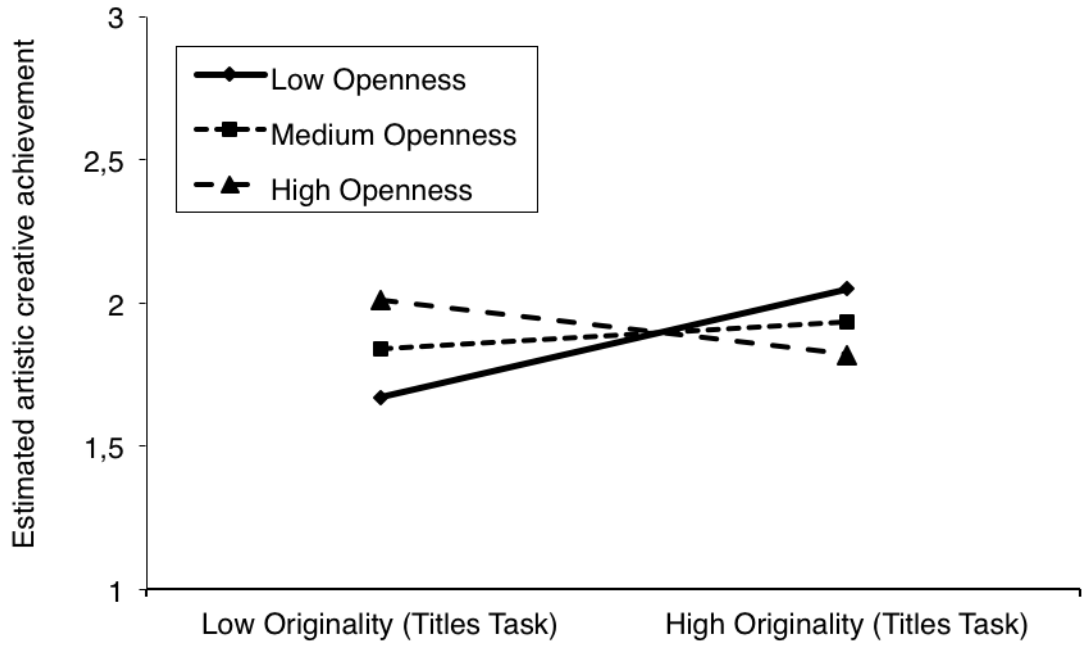

Figure 15. The moderator role of Openness (low, medium, high) on the effect of response originality (low, high level) on artistic creative achievement.

8.2.3. Conclusions

The analyses performed in order to understand the main predictors of artistic creative achievement show a clear pattern that partially confirmed the results emerged in the previous analyses. Personality traits and tendencies and divergent abilities (the ability to produce original responses and to fluently produce many alternatives) emerged as important predictors of artistic creative achievement. Different from the scientific domain, convergent abilities did not emerge as significant predictors. Also in the artistic domain, however, self-efficacy emerged as an important predictor of creative achievement. This tendency appears to be therefore a central individual disposition for achieving high creativity levels. Similarly to the results emerged from the scientific domain, the creative abilities (in this case the ability to produce original alternatives) interact with a personality trait in predicting the artistic creative achievement. A complex interaction between Openness and originality indeed shows the dynamics between the two variables in determining creative achievement. Once again, these results demonstrate the importance of considering a complex blend of creative abilities and personality dispositions in measuring and predicting creative achievement.

8.3. Everyday creative achievement

Similarly to the analyses performed on scientific and artistic creative achievement, the analyses on everyday creative achievement have been divided in two progressive steps. The first step used a hierarchical regression model to explore the main predictors of everyday creative achievement. A second phase of the analyses further explores the effects emerged from this analysis, analysing possible interaction effects.

8.3.1. The “everyday” sample: science students, art students, creative professionals

Everyday creative achievement emerged from the previous analysis as the creative achievement form with the highest scores in the three samples tested in the CREAM project. Moreover, everyday creative achievement emerged in the preliminary analysis as a sort of bridge between scientific and artistic creative achievement, sharing some elements with both forms of creative achievement (see the SEM model in Figure 1). For this reason all participants have been included in the analyses, exploring possible differences between the three domains.

For a detailed description of the entire sample please refer to section 5.1. Some summarizing elements are here provided. The total number of participants was 322 (126 science students, 127 art students, 69 creative professionals). The mean age of the entire sample was 25.55 (*SD*=6.59), with 177 males and 145 females. In order to introduce the domain variable in the regression model two dummy variables have been created, taking the creatives domain as reference category.

8.3.2. Results and discussion

Similarly to the analyses provided in the scientific and artistic domains, a hierarchical regression model has been tested. Since all participants have been included in the analysis a further block has been included in the model, which explores the predictive power of participants’ domain on the everyday creative achievement through the use of two dummy variables. The first blocks included the control variables, starting (step 1) with the gender and age of the participants, followed by participants’ domain (step 2), the Big 5 traits (step 3) and the motivation and self-efficacy individual tendencies (step

4), and ending with the general cognitive abilities (step 5). In the following blocks, the creative abilities have been introduced: divergent abilities in step 6, convergent abilities in step 7, assessment ability in step 8.

The model (considering the last significant block) predicted a significant portion of the variance (Adjusted R^2 = .24) of the everyday creative achievement (Table 21). Five blocks in particular determined a significant change in the model, and in particular the block containing participants' age, the block with the personality traits (and in particular Extraversion), the block with the personality tendencies (and in particular self-assessment), the block with divergent abilities, and finally the block with convergent abilities.

A differentiated set of variables predicted everyday creative achievement. The main predictors of this form of achievement, in particular, are participants' age, Extraversion, self-efficacy, and Titles originality, which negatively predicted the creative achievement. First of all these results highlighted that the participants' domain did not effect the everyday creative achievement. On the contrary, it was predicted by the age of the participants. This result seems to suggest that the difference in everyday creative that emerged in the ANOVA analyses was primarily related to a difference in age between the three samples (and in particular between the advertisement professionals and the art and science students). The expertise could therefore help in increasing the creative achievement in the everyday life, irrespectively from one's knowledge domain. An overall view of the regression model shows that the everyday creative achievement resembles more the artistic achievement than the scientific achievement, being characterized by personality dimensions and divergent abilities (consistently with the correlational analyses). Differently from the artistic creative achievement, which was mainly related to Openness and Conscientiousness (negatively in the latter case), everyday creative achievement is predicted by Extraversion. This personality trait is highly related to the high energy derived from the interaction with the external world. This is indeed extremely important for the everyday creative achievement, which requires a constant and interactive engagement with the external world. Self-efficacy, again, emerged as a central predictor of creative achievement also in the everyday life. This personal attitude therefore seems a central axis around which creative achievement is developed. Finally Titles originality emerged as a negative predictor of everyday creative achievement. On the basis of the complex interaction of this creative ability with personality, further analyses have been provided to explain this effect.

Table 21. Hierarchical multiple regression on everyday creative achievement scores.

	Everyday Creative Achievement							
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
Gender	0.08	0.08	0.06	0.04	0.04	0.06	0.03	0.04
Age	0.23**	0.17*	0.13	0.13	0.12	0.13	0.12	0.13
Science vs. Creatives		-0.15	-0.08	-0.01	-0.01	0.12	0.15	0.12
Art vs. Creatives		-0.10	-0.03	0.09	0.09	0.22*	0.23*	0.22*
Extraversion			0.22**	0.18**	0.18**	0.13*	0.11	0.10
Agreeableness			0.02	0.01	0.01	-0.01	-0.02	-0.02
Conscientiousness			-0.08	-0.10	-0.10	-0.08	-0.06	-0.07
Emotional stability			0.06	-0.02	-0.01	-0.03	-0.04	-0.03
Openness			0.10	0.02	0.02	0.01	0.00	0.01
Intrinsic Motivation				-0.01	-0.01	-0.01	0.01	0.01
Extrinsic Motivation				0.01	0.01	0.01	0.01	0.01
Self efficacy				0.34**	0.34**	0.33**	0.33**	0.33**
Intelligence					-0.02	-0.01	0.05	0.05
Figures Fluency						0.09	0.09	0.10
Real Problem Fluency						0.11	0.16	0.15
Titles Fluency						0.09	0.07	0.07
Real problem Originality						0.05	0.07	0.07
Figures Originality						0.08	0.08	0.08
Titles Originality						-0.12*	-0.11	-0.11
RAT							-0.08	-0.05
Insight problems							-0.12	-0.11
Assessment								0.05
R^2	0.04	0.05	0.11	0.18	0.18	0.23	0.24	0.24
ΔR^2	0.04	0.01	0.06	0.08	0.00	0.05	0.02	0.00
F	7.70**	4.67**	4.94**	6.52**	6.01**	5.52**	5.38**	5.15**
ΔF	7.70**	1.61	4.90**	9.85**	0.14	3.70**	3.22*	0.58
df	288	286	281	278	277	271	269	268

Notes: Step 1: Gender, Age; Step 2: Dummy 1, art students vs. creatives, Dummy 2, science students vs. creatives; Step 3: Extraversion, Agreeableness, Conscientiousness, Openness, Emotional stability; Step 4: Intrinsic motivation, Extrinsic motivation, Self efficacy; Step 5: Intelligence; Step 6: Figures fluency, Realistic problems fluency, Titles Fluency, Figures originality, Realistic problems originality, Titles originality; Step 7: RAT, Insight problems; Step 8: Assessment. Numbers in the first seven rows represent standardized regression coefficients; * $p < .05$, ** $p < .01$

The regression model however showed that also the block containing convergent abilities produced a significant change in R^2. In particular, the ability to find solutions through insight shows a tendency to significantly (p=.09) and negatively predict everyday creative achievement. This tendency suggests that insight is detrimental for this form of creative achievement. Moreover, a final consideration should be provided in relation to the lack of significant predictive power of the Realistic problems task. The ability to produce alternative solutions to realistic problems seem particularly associated to the everyday creative achievement, as demonstrated by the correlational analyses. However, no effect in the fluency of Realistic problems task emerged.

In order to more deeply explore the role of originality in the Titles task, of solving problems through insight, and of the fluency in Realistic problems, we performed a second regression analysis where the significant predictors emerged in the previous analyses were included in the model as well as insight, realistic problems task fluency, and an interaction of originality with Openness. This interaction was introduced to explore the negative effect emerged in the originality scores of Titles task, and, on the basis also of the results emerged in the analysis of artistic creative achievement, to understand whether this effect could originate from an interaction with the Openness personality trait. The regression model shown in Table 22 was significant and predicted a slightly higher portion of variance of everyday creative achievement than the previous model (Adjusted R^2 = .26). It confirmed the positive predictive effect of Extraversion, Openness, and self-efficacy; moreover, a significant positive effect of the fluency of Realistic problems task and a significant negative predictive effect of insight emerged, but age did not emerged as significant predictor in this unified model. The effect of Titles task originality changed from negative to positive and, as predicted, it showed an interactive effect with Openness. A simple slopes computation, exploring in particular a moderation effect of originality on Openness, showed that Openness tends to predict everyday creative achievement at low levels of originality ($ß$ = .05, SE = .03, p = .08), did not predict it at medium level ($ß$ = -.01, SE = .03, p = .62), and significantly and negatively predict it at high levels of originality ($ß$ = -.07, SE = .03, p = .04). Figure 16 in particular shows that at low level of originality, the increase in Openness tends to increase the everyday creative achievement. This effect did not emerged at low levels of originality, and reversed at high levels of originality. This result suggests that when an individual is characterized by a good ability to produce original ideas, Openness can be detrimental to his/her everyday creative achievement. If we merge this result with the results obtained in the artistic creative achievement, we could hypothesise that Openness and originality can foster creative achievement when an individual is characterized by low levels of originality or Openness, respectively. However, their effect can come into conflict at high levels of Openness or originality, where we could hypothesise that possessing one of these two characteristics might be sufficient to obtain high creative accomplishments. However, even if a similar interaction between originality and Openness emerged in the artistic creative achievement, where the Openness level moderates the effect of originality on creative achievement, the simple slopes computation showed, in the case of everyday achievement, that originality level acts as moderator of the effect of Openness on creative achievement. Different dynamics in the interaction between the two variables characterized therefore artistic and everyday creative achievement.

Table 22. Regression analysis of the effect of Age, Extraversion, Openness, self-efficacy, Realistic problems task fluency, Titles task originality, insight, and the interaction of Openness and Titles task originality on the everyday creative achievement.

	Everyday creative achievement		
	β	*SE*	*t*
Age	.004	.004	1.19
Extraversion	.044	.018	2.47*
Openness	.128	.050	2.55*
Self-efficacy	.032	.006	5.04**
Realistic problems fluency	.017	.004	3.86**
Titles task originality	3.791	.1.419	2.67**
Insight	-.300	.099	-3.03**
Openness X Titles originality	-.709	.244	-2.90**
(Constant)	.109	.324	0.33
$F(8,286) = 12.60$, $p < .001$ Adjusted $R^2 = .26$			

Notes: * $p < .05$; ** $p < .01$

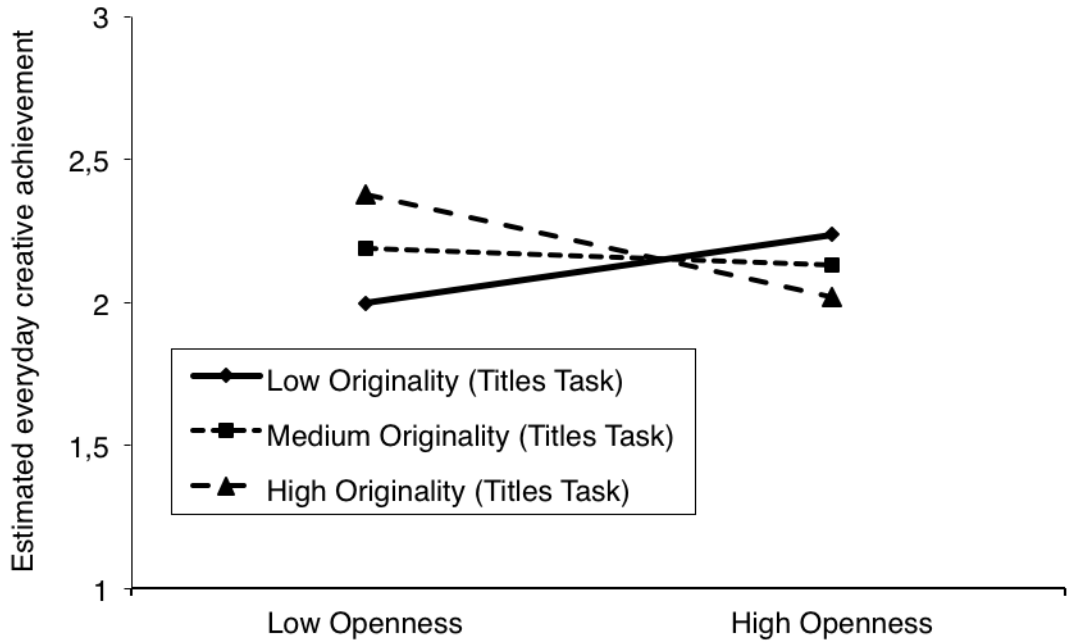

Figure 16. The moderator role of response originality (low, medium, high) on the effect of Openness (low, high level) on everyday creative achievement.

8.3.3. Conclusions

The analyses performed in order to understand the main predictors of everyday creative achievement show that everyday creative achievement is characterized by a similar pattern of predictors to the artistic domains. However, some peculiarities distinguished these two forms of creative accomplishments. First, everyday creative achievement emerged to increase with the increase of age. However, no effect of participants' domains emerged from the analyses, substantially comparing the creative achievement of students and professionals in the everyday life. Moreover, Extraversion, i.e., the high engagement in interacting with the external world, emerged as an important predictor of creative achievement, confirming the importance of the relationships with the external world to achieve high creativity levels in the everyday life. Self-efficacy again confirmed its importance in predicting creative achievement, reinforcing its role as one of the main predictors of the creative success. Convergent and divergent abilities were both involved in everyday creative achievement, the former (and in particular the ability to find problem through insight) negatively predicting this form of achievement, the latter positively predicting it. In particular, a positive role was played by the ability to produce many alternative solutions (fluency) to realistic problems; this ability emerged to be indeed important in predicting everyday creative achievement. Moreover, the analyses showed that the ability to produce original ideas can predict positively the creative success in everyday life. However, this divergent ability interacts with the Openness trait in determining creative achievement, confirming the complex relationship between divergent thinking abilities and personality. A balanced ratio between these two variables emerged therefore to be a central predictor of creative achievement in everyday life. This result, again, confirmed the necessity to consider a complex blend of variables in the definition of the different from of creative achievement. In the next section, dedicated room will be therefore dedicated to the definition of specific profiles defining creative achievement in accordance with the results emerged in the present section.

9. Profiling creative achievement in different knowledge domains

In line with the recent approach devoted to the measurement of creative potential across different domains (see for example Lubart, Zenasni, & Barbot, 2013; Runco & Acar, 2012), the results obtained though the analyses performed on the CREAM test battery database allow defining specific creative profiles within the three creative domains (artistic, scientific, and everyday life) explored within the CREAM project. The potential is usually defined as a latent state considered part of an individual's "human capital" (Walberg, 1988), defined by competencies (knowledge and skills) strictly related to achievement. The degree to which an individual shows a certain degree of potential across domains strictly depends on the nature of the cognitive abilities and personality dispositions required by each domain. Usually, starting from a specific theoretical approach defining creativity, the different components of creativity have been explored in different knowledge domains to understand the role of different resources in the definition of the creative potential within each domain. Lubart et al. (2013), in particular, proposed a creative profiler, defining the creative potential of an individual within different domains starting from the components of creativity defined in the investment theory by Sternberg and Lubart (1995). The creative profiler, in particular, allows measuring the likelihood that an individual's profile is similar to an "optimal" creative profile for a given creative work.

Adopting a similar approach to that recently used in the measuring of creative potential (Lubart et al., 2013), we defined the creative potential in the scientific, artistic, and everyday domain, identifying specific potential levels within each domain. However, differently from the literature, where the profiles definition are based on variables emerged in the literature as important for creativity, we based our profiles definition on the results obtained from the administration of a multi-sided test battery measuring comprehensively the creative behaviour. After the definition of the test battery on the basis of the data emerged from the creativity literature (see Deliverable D2.1), through the administration of the test battery to a consistent sample of science and art students and creative professionals, we were able to identify the most important predictors of creative achievement in the artistic, scientific, and everyday domain. Using the creative achievement as a reference measure to define the "optimal" creative potential, we therefore identified different profiles within each domain, defining different creative potential levels for the achievement in the three domains. Adopting such an approach, and using the creative achievement as a reference measure, we were therefore able to identify four specific profiles composed by the most important predictors of creative achievement within each domain, defining a low, a medium-low, a medium-high, and a high (optimal) potential for the achievement in the scientific, artistic, and everyday domain.

9.1. The scientific profile

In order to identify specific profiles defining the creative potential within the scientific domain, the scientific creative achievement scores of the scientific sample (science students) have been ranked in four distinct categories: low creative achievement, medium-low creative achievement, medium-high creative achievement, high creative achievement. As shown in Table 23, this approach allowed to obtain four significantly

distinct creative achievement categories, $F(3,126)=195.59$, $p<.001$; Bonferroni-corrected post-hoc analyses showed indeed that the achievement score between the four categories was significant different (*ps*<.001).

Table 23. Descriptive statistics (mean and standard deviation) of the scientific achievement scores in the four achievement categories.

Creative achievement level	N	Mean	SD
Low	32	1.23	.07
Medium-Low	31	1.44	.07
Medium-High	33	1.66	.08
High	31	2.13	.28

Starting from the results highlighting the variables predicting scientific creative achievement (Section 8.1), four different profiles, describing the different potential levels to succeed within the scientific domain have been obtained (Table 24).

Table 24. Descriptive statistics (mean and standard deviation of raw and z-transformed scores) of the main predictors of scientific creative achievement within each potential level.

Potential	Creative achievement predictors	N	Mean	SD	Mean (Z-scores)	SD (Z-scores)
Low	RAT	32	.57	.15	.15	.72
	Insight	32	.59	.25	.01	1.09
	Fluency (Titles)	32	12.65	6.53	-.29	.76
	Self-efficacy	32	28.12	3.29	-.32	.84
Medium-Low	RAT	31	.55	.22	.08	1.05
	Insight	31	.57	.19	-.067	.86
	Fluency (Titles)	31	15.90	7.57	.09	.88
	Self-efficacy	31	28.84	3.41	-.14	.88
Medium-High	RAT	33	.55	.19	.05	.88
	Insight	33	.61	.20	.11	.88
	Fluency (Titles)	33	14.20	6.84	-.10	.79
	Self-efficacy	33	29.57	3.76	.05	.97
High	RAT	31	.48	.26	-.29	1.26
	Insight	31	.57	.26	-.06	1.16
	Fluency (Titles)	30	18.00	12.00	.33	1.39
	Self-efficacy	31	31.03	4.55	.42	1.17

Notes: Low, Medium-Low, Medium-High, and High potential correspond to the four levels (from low to high) of scientific creative achievement.

The predictors have been indeed mapped within the four scientific creative achievement levels (Table 24), defining a low potential profile, a medium-low potential profile, a medium-high potential profile, and a high potential profile. As shown in Figure 17, the profile represents an ensemble of variables which distribution identifies a specific potential to achieve creativity in the scientific domain[2]. As emerged in the analyses described in the previous section, the predictors should be taken together in order to understand creative achievement. For this reason, in order to define a potential level, the researcher should not consider one variable at a time, but should measure and consider all predictors in order to detect the specific profile associated to a creative achievement level. The high potential profile identifies in particular the "optimum" potential level for success in the scientific domain. Some specific consideration on the predictors defining the four profiles should be given.

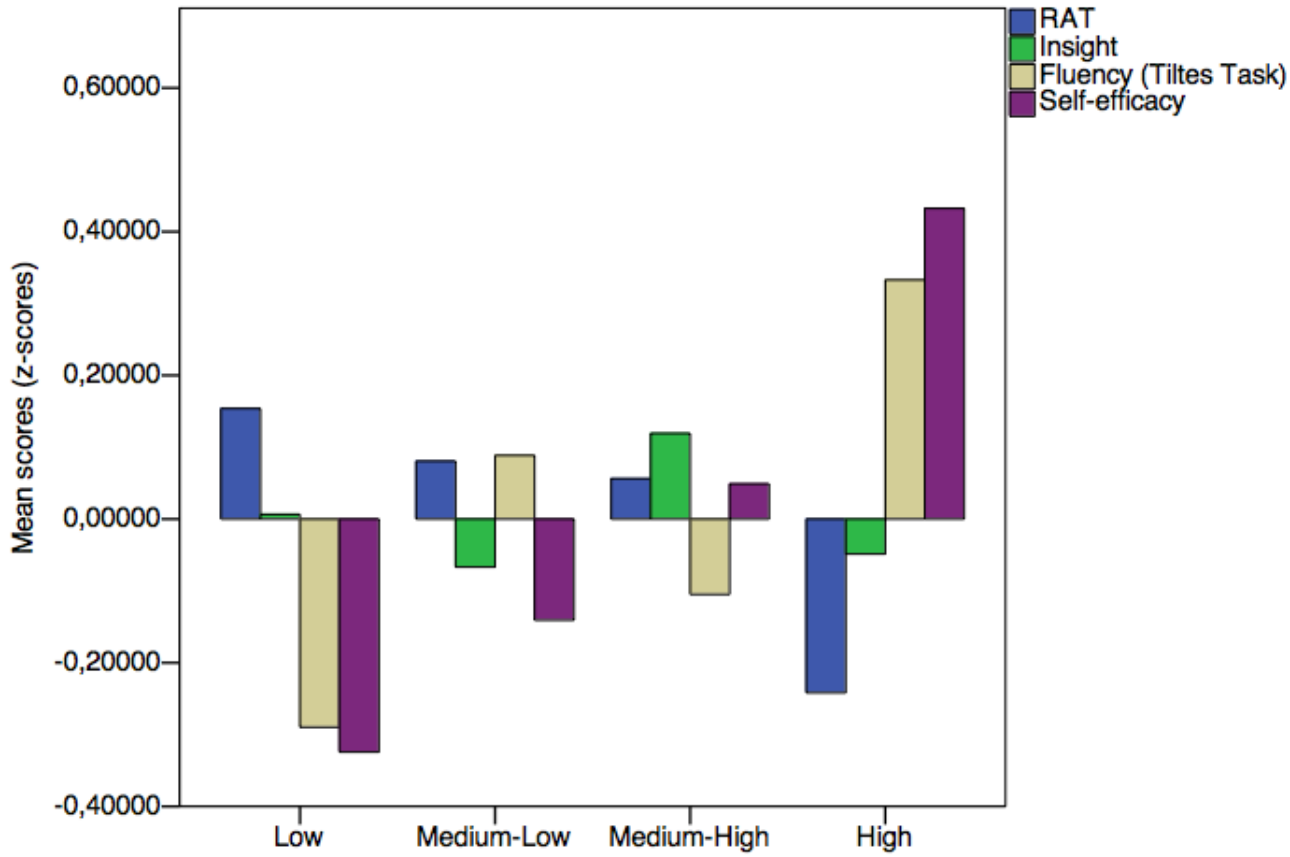

Figure 17. Four profiles composed by the main predictors of scientific creative achievement, defining low, medium-low, medium-high, and high creative potential in the scientific domain.

[2] In order to combine the predictors in specific profiles, variables raw scores have been z-transformed to compare them on the same distribution.

First of all, Figure 17 shows two clearly distinct profiles, the low potential profile and the high potential profile. The two medium profiles result instead less defined, constituting intermediate positions between the low and the high creative profiles, where the variables distribution is less clear. The two medium profiles (medium-low and medium-high) therefore should not be considered as clearly distinct ensembles of variables, but as a unique intermediate position defining a medium potential to succeed in the scientific creative domain. The low and high profiles instead totally resemble the results emerged in the regression models, summarizing the associations of the variables emerged as predictors of the scientific creative achievement. In the low potential profile, in particular, RAT scores are higher than in the other profiles, Titles task fluency and self-efficacy are extremely low, while problem solving through insight is higher than in high potential profile. On the contrary high potential profile shows high fluency and self-efficacy levels, and lower RAT and insight levels. The result of insight in particular should be considered in relation to the interactive effect emerged in the regression analysis, which demonstrated a moderation of insight on the self-efficacy effect on creative achievement. Since the high potential profile is characterized in the scientific domain by a high self-efficacy, insight does not constitute in this profile a central ability for the creative achievement. On the contrary, insight constitutes an important predictor of creative achievement only at low and medium level of self-efficacy as emerged for example in the medium-high potential profile, where the low self-efficacy level is counteracted by higher insight scores.

A final consideration on the profiles regards some potential misuses. The profiles delineated in the present section should not be taken as crystallized structures for the definition of scientific creative achievement. These profiles for example do not take into account the complex interactions between convergent abilities (in particular insight) and personal attitudes (i.e. self-efficacy). These profiles should be always considered taking into account the results emerged from the previous analyses, namely considering the complex interaction between the variables and the different and relative predictive power of each variable. However, they could represent useful reference tools for the analysis of creative achievement in the scientific domain, showing the most important variables in the definition of creative achievement, and offering useful reference scores for the identification of the individual potential level for succeed in the scientific domain.

On the basis of the results described in the present deliverable, we suggest that the profiling of the creative potential within the scientific domain can be performed using a dedicated selection of tests extracted from the CREAM test battery. This selection allows obtaining a short test battery to measure the creative achievement potential within the scientific domain. In particular, on the basis of the results, four specific tasks measuring the main predictors of creative achievement in the scientific domain constitute the "scientific short test battery": the RAT task, insight problems, Titles task (extracting in particular the fluency scores), and the Self-Efficacy Scale. These four tests can allow to define the creative achievement potential level within the scientific domain measuring the main predictors of creative achievement.

9.2. The artistic profile

In the identification of specific potential profiles within the artistic domain we followed the same methodological approach used in the scientific domain. In particular, in order to identify specific profiles defining the creative potential within the artistic domain, the

artistic creative achievement scores of the artistic sample (art students) have been ranked in four distinct categories: low creative achievement, medium-low creative achievement, medium-high creative achievement, high creative achievement. As shown in Table 25, this approach allowed to obtain four significantly distinct creative achievement categories, $F(3,126)=243.83$, $p<.001$; Bonferroni-corrected post-hoc analyses showed indeed that the achievement score between the four categories was significant different (*ps*<.001).

Table 25. Descriptive statistics (mean and standard deviation) of the artistic achievement scores in the four achievement categories.

Creative achievement level	N	Mean	SD
Low	30	1.41	.11
Medium-Low	34	1.67	.08
Medium-High	28	1.96	.08
High	35	2.39	.25

Starting from the results highlighting the variables predicting artistic creative achievement (Section 8.2), four different profiles, describing the different potential levels to succeed within the artistic domain have been obtained (Table 26, Figure 18).

The predictors have been in particular mapped within the four artistic creative achievement levels (Table 26), defining a low potential profile, a medium-low potential profile, a medium-high potential profile, and a high potential profile. As shown in Figure 18, the profile represents an ensemble of variables which distribution identifies a specific potential to achieve creativity in the artistic domain. As previously suggested, the predictors identified within the artistic domain should be considered together in order to understand creative achievement. For this reason, in order to define a potential level, the researcher should not consider one variable at a time, but should measure and consider all predictors in order to detect the specific profile associated to a creative achievement level. The high potential profile identifies in particular the "optimum" potential level for succeed in the artistic domain.

As also emerged in the analysis of science profiles, two clearly distinct profiles can be identified in Figure 18, the low potential profile and the high potential profile. The two medium profiles result instead less defined, constituting intermediate positions between the low and the high creative profiles, where the variables distribution is less clear. Again, the two medium profiles (medium-low and medium-high) should not be considered as clearly distinct ensembles of variables, but as a unique intermediate position defining a medium potential to succeed in the artistic creative domain. The low and high profiles instead totally resemble the results emerged in the regression models. In the low potential profile, in particular, a high level of Conscientiousness results highly evident. At the same time, low levels of fluency, originality, Openness, and self-efficacy are evident. Moreover, low assessment scores emerged, meaning a high ability to assess accordingly to the norm (which the regression highlighted to be a negative predictor of the artistic creative achievement). The high potential profile, on the contrary, shows low

levels of Conscientiousness and a totally opposite trend in fluency, originality, Openness, assessment ability, and self-efficacy.

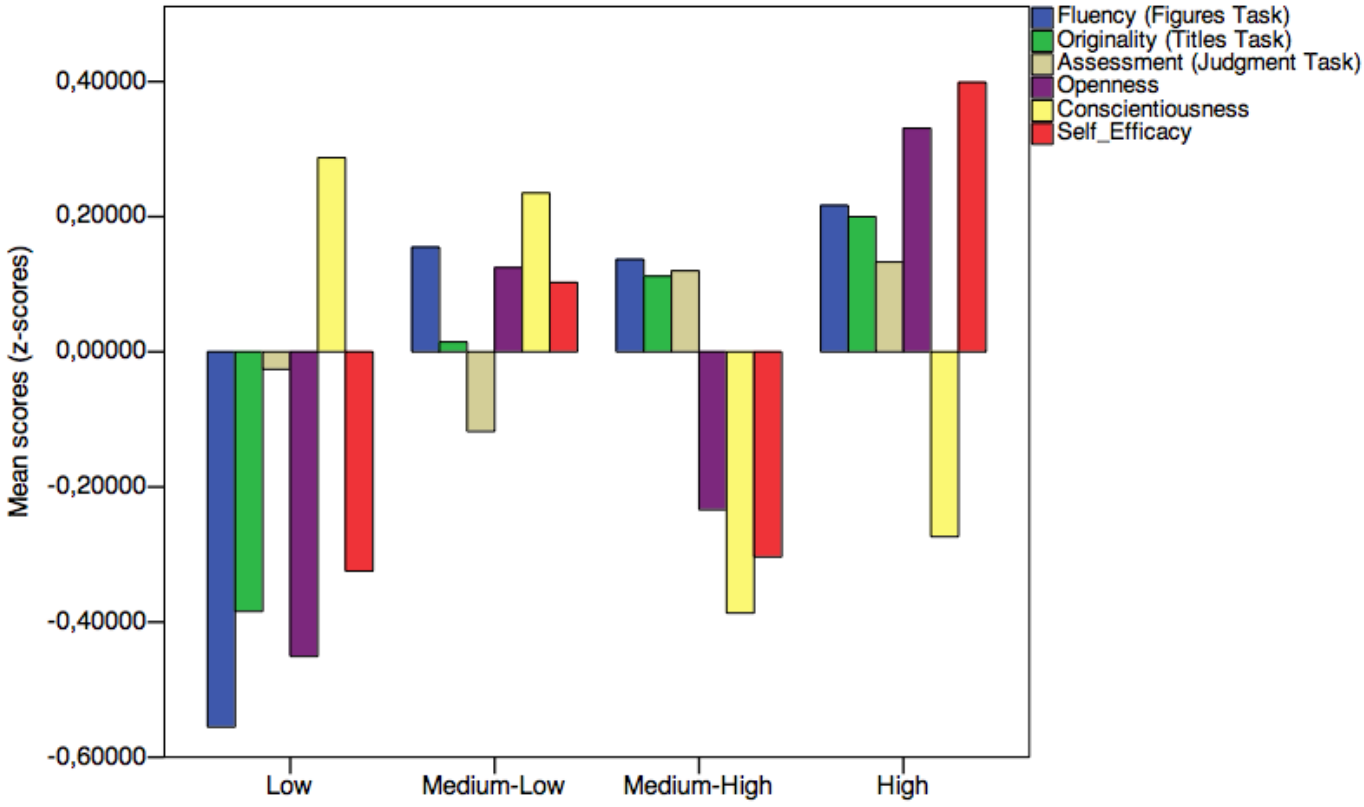

Figure 18. Four profiles composed by the main predictors of artistic creative achievement, defining low, medium-low, medium-high, and high creative potential in the artistic domain.

Table 26. Descriptive statistics (mean and standard deviation of raw and z-transformed scores) of the main predictors of artistic creative achievement within each potential level.

Profile	Creative achievement predictors	N	Mean	SD	Mean (Z-scores)	SD (Z-scores)
Low	Fluency (Figures)	30	16.87	6.48	-.55	.65
	Originality (Titles)	30	1.39	.26	-.38	.84
	Assessment	30	.93	.25	-.02	.84
	Openness	30	5.40	1.03	-.45	1.07
	Conscientiousness	30	5.51	1.01	.29	.82
	Self-efficacy	30	27.13	4.69	-.32	1.17
Medium-Low	Fluency (Figures)	34	23.47	11.55	.11	1.17
	Originality (Titles)	32	1.51	.26	.01	.86
	Assessment	34	.89	.22	-.15	.72
	Openness	34	5.89	.90	.06	.94
	Conscientiousness	34	5.47	1.26	.25	1.04
	Self-efficacy	34	28.79	3.54	.09	.88
Medium High	Fluency (Figures)	28	24.35	8.73	.20	.88
	Originality (Titles)	24	1.57	.35	.18	1.14
	Assessment	28	.97	.37	.09	1.22
	Openness	27	5.78	.94	-.05	.98
	Conscientiousness	27	4.76	1.20	-.33	.99
	Self-efficacy	28	27.43	3.58	-.25	.89
High	Fluency (Figures)	35	24.34	9.99	.20	1.01
	Originality (Titles)	33	1.57	.33	.19	1.07
	Assessment	35	.97	.35	.09	1.16
	Openness	35	6.18	.84	.36	.87
	Conscientiousness	35	4.88	1.23	-.23	1.01
	Self-efficacy	35	30.00	3.64	.39	.91

Notes: Low, Medium-Low, Medium-High, and High potential correspond to the four levels (from low to high) of artistic creative achievement.

Also in the case of the artistic potential profiles, we should remember that they must be considered taking into account the results emerged from the previous analyses, namely considering the complex interaction between the variables and the different and relative

predictive power of each variable. These profiles for example do not take into account the complex interactions between divergent abilities (in particular originality) and personal attitudes (i.e. Openness). However, they could represent useful reference tools for the analysis of creative achievement in the artistic domain, showing the most important variables in the definition of creative achievement, and offering useful reference scores for the identification of the individual potential level for succeed in the artistic domain.

On the basis of the results described in the present deliverable, we suggest that the profiling of the creative potential within the artistic domain can be performed using a dedicated selection of tests extracted from the CREAM test battery. As in the case of scientific achievement, this selection allows obtaining a short test battery to measure creative achievement potential within the artistic domain. In particular, on the basis of the results, five specific tasks measuring the main predictors of creative achievement in the artistic domain constitute the "artistic short test battery": Figures Task (extracting in particular the fluency scores), Titles task (extracting in particular the originality scores), Judgment Task, TIPI (extracting in particular Openness and Conscientiousness personality traits), and the Self-Efficacy Scale. These five tests can allow to define the creative achievement potential level within the artistic domain measuring the main predictors of creative achievement.

9.3. The everyday profile

Finally, in order to identify specific profiles defining the creative potential within everyday life, also the everyday creative achievement scores of the entire sample (science students, art student, and creative professionals) have been ranked in four distinct categories: low creative achievement, medium-low creative achievement, medium-high creative achievement, high creative achievement. As shown in Table 27, this approach allowed to obtain four significantly distinct creative achievement categories, $F(3,323)=614.80$, $p<.001$; Bonferroni-corrected post-hoc analyses showed indeed that the achievement score between the four categories was significant different ($ps<.001$).

Table 27. Descriptive statistics (mean and standard deviation) of the everyday achievement scores in the four achievement categories.

Creative achievement level	N	Mean	SD
Low	81	1.59	.16
Medium-Low	84	1.94	.07
Medium-High	81	2.22	.10
High	78	2.77	.29

Starting from the results highlighting the variables predicting everyday creative achievement (Section 8.3), four different profiles, describing the different potential levels to creatively succeed within the everyday life have been obtained (Table 28, Figure 19).

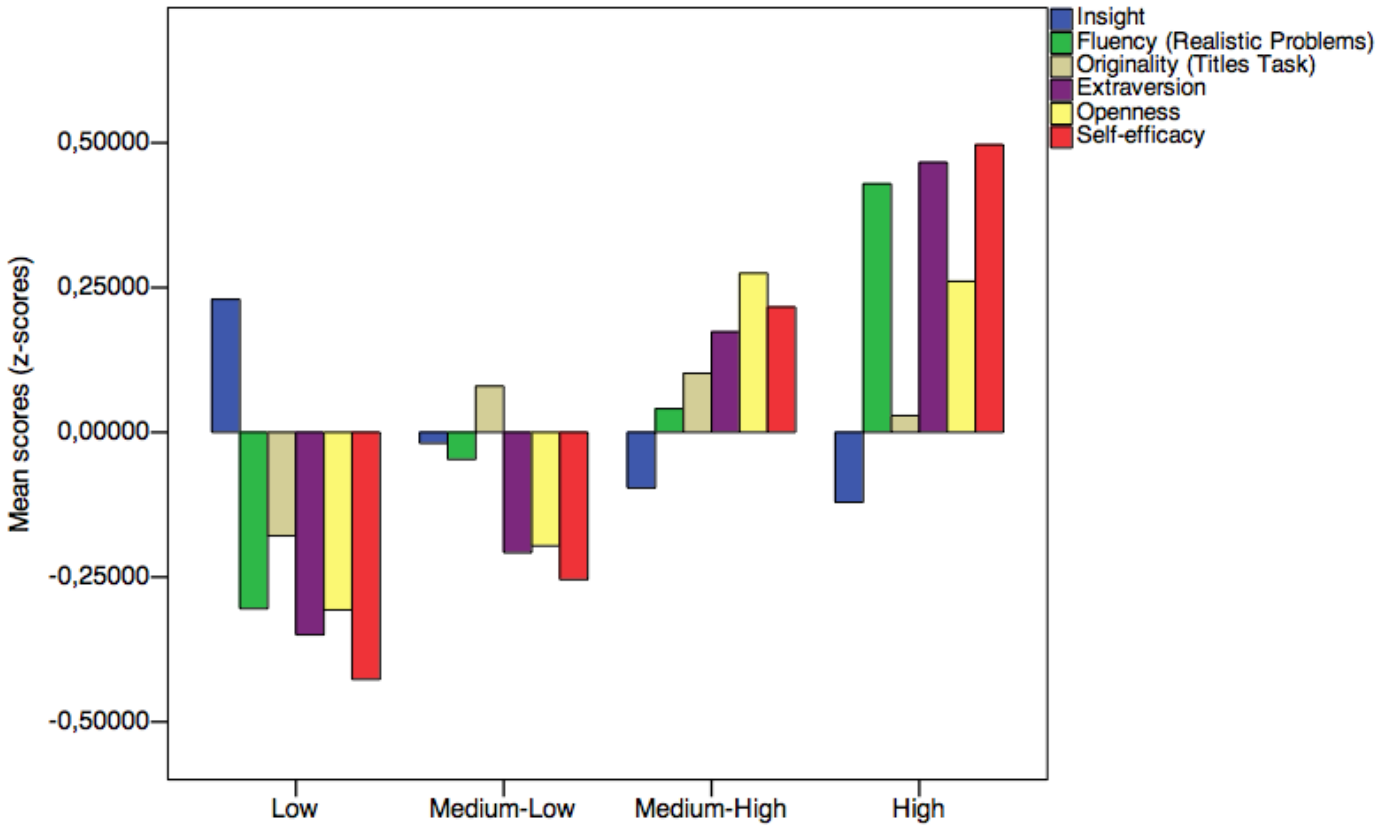

Figure 19. Four profiles composed by the main predictors of everyday creative achievement, defining low, medium-low, medium-high, and high creative potential in the everyday life.

The predictors have been in particular mapped within the four everyday creative achievement levels (Table 28), defining a low potential profile, a medium-low potential profile, a medium-high potential profile, and a high potential profile. As shown in Figure 19, the profile represents an ensemble of variables which distribution identifies a specific potential to achieve creativity in the everyday life.

As also emerged in the analysis of science and art profiles, the low potential profile and the high potential profile emerged as clearly distinct profiles in Figure 19. The two medium profiles result instead less defined, constituting intermediate positions between the low and the high creative profiles, where the variables distribution is less clear. The low and high profiles instead totally follow the results emerged in the regression models. In the low potential profile, in particular, a high level of the ability to solve problem through insight results evident. Instead low levels of fluency, originality, Openness, Extraversion, and self-efficacy are evident. The high potential profile, on the contrary, shows low levels of insight ability and a totally opposite trend in fluency, originality, Extraversion, Openness, and self-efficacy. As highlighted by the regression analyses high levels of Extraversion and self-efficacy emerged to be associated to a high potential to succeed in creative activities in the everyday life. Originality data in

particular should be considered in relation to the interactive effect emerged in the regression analysis, which demonstrated a moderation of originality on the Openness effect over everyday creative achievement. Since the high potential profile is characterized by high Openness levels, originality could not constitute in this profile (see Figure 19) a central ability for the creative achievement.

Table 28. Descriptive statistics (mean and standard deviation of raw and z-transformed scores) of the main predictors of everyday creative achievement within each potential level.

Profile	Creative achievement predictors	N	Mean	SD	Mean (Z-scores)	SD (Z-scores)
Low	Insight	81	.54	.26	.23	1.04
	Fluency (Real Probl.)	76	11.67	5.05	-.37	.85
	Originality (Titles)	77	1.53	.40	-.23	1.09
	Extraversion	81	3.71	1.42	-.39	.97
	Openness	81	5.40	1.01	-.35	1.01
	Self-efficacy	80	28.03	4.12	-.39	1.01
Medium-Low	Insight	84	.48	.25	-.01	.99
	Fluency (Real Probl.)	82	13.62	5.53	-.04	.93
	Originality (Titles)	83	1.63	.39	.06	1.06
	Extraversion	84	3.98	1.42	-.21	.98
	Openness	84	5.56	1.12	-.19	1.12
	Self-efficacy	84	28.64	3.43	-.24	.84
Medium High	Insight	81	.46	.24	-.09	.96
	Fluency (Real Probl.)	79	13.97	5.35	.01	.90
	Originality (Titles)	76	1.65	.32	.12	.89
	Extraversion	80	4.57	1.31	.19	.90
	Openness	80	6.03	.79	.28	.79
	Self-efficacy	81	30.40	3.73	.18	.92
High	Insight	78	.44	.24	-.13	.97
	Fluency (Real Probl.)	77	16.29	6.88	.40	1.15
	Originality (Titles)	75	1.63	.32	.04	.89
	Extraversion	78	4.93	1.34	.44	.92
	Openness	78	6.05	.87	.29	.87
	Self-efficacy	78	31.61	4.05	.48	.99

Notes: Low, Medium-Low, Medium-High, and High potential correspond to the four levels (from low to high) of everyday creative achievement.

Also in the case of the everyday potential profiles, they must be considered taking into account the complex results emerged from the correlational, the ANOVAs, and the regression analyses. Even if the profiles can show the most important variables in the definition of everyday creative achievement and offer useful reference scores for the identification of the individual potential level for succeed in creative activities in the everyday life, the predictor weight of the single variable and the interactive effect between all variables indicated by the profiles should be considered in the measuring of the creative performance and the creative attitude of the individual.

As in the case of scientific and artistic achievement, on the basis of the results described in the present deliverable, we suggest that the profiling of the creative potential within the everyday domain can be performed using a dedicated selection of tests extracted from the CREAM test battery. This selection allows obtaining a short test battery to measure creative achievement potential within everyday life. In particular, on the basis of the results, five specific tasks measuring the main predictors of creative achievement in the everyday domain constitute the "everyday short test battery": insight problems, Realistic problems Task (extracting in particular the fluency scores), Titles task (extracting in particular the originality scores), TIPI (extracting in particular Extraversion and Openness personality traits), and the Self-Efficacy Scale. These five tests can allow to define the creative achievement potential level within the everyday life measuring the main predictors of everyday creative achievement.

10. Concluding section

Starting from the correlational analyses between the measures constituting the CREAM test battery, continuing with an analyses exploring the differences in the creative abilities and tendencies between the three samples tested in the project (science students, art students, creative professionals), the present deliverable ends with the identification of the main predictors of the creative achievement in the scientific, artistic, and everyday domains. More specifically, on the basis of the analyses, science students were used as reference sample to explore scientific creative achievement, art students to analyse artistic creative achievement, and the entire sample, comprising creative professionals, to explore creative achievement in the everyday life. On the basis of these analyses specific profiles have been identified, specifying different levels of the potential for creative achievement within the scientific, artistic, and everyday domains. The profiling of creative potential within the three domains allowed identifying specific tests to measure creative achievement within the scientific, artistic, and everyday domain. In particular, we defined three specific short versions of the CREAM test battery to measure the creative potential within the scientific, artistic, and everyday domains.

The analyses, in particular, have been performed on a final sample of 322 participants. Totally, the CREAM test battery has been administered, within two administration campaigns, to more than 400 participants. The second administration campaign, in particular, reached its aim at balancing the sample characteristics, increasing the number of participants in the artistic domain.

More specifically, the correlational and ANOVA analyses largely replicated the results obtained after the first period of the project and presented in Deliverable D2.1. The correlational analyses, in particular, highlighted that convergent and divergent thinking abilities are distinct abilities, with no association between them. Moreover, assessment ability emerged as a clearly distinct ability from ideational abilities (convergent and divergent). General trends emerged from the associations of convergent and divergent abilities with intelligence and personality. While, indeed, convergent abilities are mainly related to intelligence, divergent abilities are mainly associated with personality traits and tendencies, in particular with Extraversion and Openness traits, and with higher levels of intrinsic motivation and self-efficacy. These associative trends seem to suggest that convergent abilities are cognitive-related abilities, while divergent abilities are more personality-related abilities.

Convergent thinking abilities and divergent thinking abilities are also differently associated with creative achievement in scientific, artistic and everyday creative achievement. Convergent abilities, and in particular the ability to solve problem through insight, are mainly related to scientific creative achievement, while divergent abilities (fluency and originality, particularly Titles task originality) are mainly related to artistic and everyday creative achievement. At the same time, intelligence resulted highly related to scientific creative achievement, while Openness, Extraversion, and Intrinsic motivation resulted more related to artistic and everyday creative achievement. The only individual tendency that results associated to all three forms of creative achievement is self-efficacy: the higher the self-efficacy level, the higher the creative achievement levels in the scientific, artistic, and everyday domains.

As per differences and similarities between the three samples, participants from the scientific domain and participants from the artistic domain seem to be characterized by similar personality trends. However, creative professionals seem to be characterized by differences in personality compared to science students, in particular they show higher levels of Extraversion, Emotional Stability, and Openness. At the same time, results show that creative professionals are characterized by a personality structure that is not highly different from the art students' personality. Creative professionals and art students differ only in the Emotional stability trait, highlighting that professionals are more emotionally stable and more resistant to stress than students. Summarizing, these results showed that the stereotypical difference in personality between science and art is not present in university students: their personality structure is essentially identical. On the other hand, the more equilibrate personality structure in creative professionals could be ascribed to the higher mean age of the creative industry sample, which can enhance and crystallize some personality dimensions (in particular Openness) typical of the artistic domain. Creative professionals, moreover, are characterized by a higher level of divergent abilities (fluency and originality) than science and art students, which are characterized by a similar data trend in divergent tasks. Science students are however characterized by higher insight ability and intelligence scores than art students and creative professionals, highlighting that convergent abilities, and in particular insight, are central abilities within the scientific domain.

These preliminary analyses devoted to the exploration of associations between variables and of differences between domains in creative abilities and tendencies, served the purpose to define specific regression models to identify the main predictors of creative achievement in the scientific, artistic, and everyday domain. Regression analyses in particular demonstrated that personality traits and in general divergent abilities are not important predictors of scientific creative achievement. An exception to this trend is the positive predictive power of the fluency ability in the Titles task, which highlighted the importance of this ability to produce different alternatives in thinking to a problem in the scientific domain. Moreover, a general tendency to negatively predict scientific creative achievement emerged in the RAT score. This result in particular should be further explored by future research, in order to completely explicate the negative predictor role of the RAT associative abilities on scientific creative achievement. In particular, as recently demonstrated within the CREAM project (see for example Deliverable D3.1), RAT triplets can be solved both with the use of insight and without insight. A significant difference in the brain structures involved in the two forms of problem solving emerged, highlighting that the solutions by insight are associated to a network of areas including cortical and subcortical regions. In particular, on the basis of these results, we can hypothesise that the negative predictor role of RAT can be influenced by the mixed nature of this task. For this reason, we suggest in future research to distinguish between solutions reached through insight and solutions obtained without insight. This methodology could help in better understanding the use of RAT in the measuring of scientific creative achievement. Finally, self-efficacy emerged as the most important predictor of creative achievement in science. However, this variable interacted also with the ability to solve problems by insight. A moderation analysis, in particular, highlighted that it positively predicted scientific creative achievement, and that it interacted with self-efficacy in the explanation of achievement. This result suggests that a complex interaction between convergent ability and

individual tendency must be considered to understand and predict scientific creative achievement.

Personality traits and tendencies and divergent abilities (the ability to produce original responses and to fluently produce many alternatives) emerged as important predictors of artistic creative achievement. Differently from the scientific domain, convergent abilities did not emerge as significant predictors. Also in the artistic domain, however, self-efficacy emerged as important predictor of creative achievement. This personal tendency appears to be therefore a central individual disposition for achieving high creativity levels. Similarly to the results emerged from the scientific domain, creative abilities (in this case the ability to produce original alternatives) interact with a personality trait in predicting the artistic creative achievement. A complex interaction between Openness and originality indeed influences the dynamics between the two variables in determining creative achievement. Once again, these results demonstrate the importance of considering a complex blend of creative abilities and personality dispositions in measuring and predicting creative achievement.

Finally, even if artistic and everyday domains are characterized by many similarities, some peculiar variables distinguished creative accomplishments within the two domains. First, everyday creative achievement emerged to increase with the increase of age. However, no effect of participants' domains emerged from the analyses, substantially comparing the creative achievement in the everyday life of students and professionals. Moreover, extraversion, i.e., the high engagement in interacting with the external world, was an important predictor of creative achievement, confirming the importance of the relationships with the external world to achieve high creativity levels in the everyday life. Self-efficacy again confirmed its importance in predicting creative achievement, reinforcing its role as one of the main predictors of the creativity success. Convergent and divergent abilities were both involved in everyday creative achievement, the former (and in particular the ability to find problem through insight) negatively predicting this form of achievement, the latter positively predicting it. In particular, a positive role was played by the ability to produce many alternative solutions (fluency) to realistic problems. Moreover, the analyses showed that the ability to produce original ideas can predict positively the creative success in everyday life. However, this divergent ability interacts with the Openness trait in determining creative achievement, confirming the complex relationship between divergent thinking abilities and personality. A balanced ratio between these two variables emerged therefore to be a central predictor of creative achievement in everyday life.

Finally, this deliverable presents three sections where specific profiles defining creative potential levels in the scientific, artistic, and everyday domains are described. In particular, using the creative achievement as a reference measure to define the "optimal" creative potential, we identified different profiles within each domain, defining different creative potential levels for the achievement in the three domains. Adopting such an approach, and using the creative achievement as a reference measure, we were therefore able to identify four specific profiles composed by the most important predictors of creative achievement within each domain, defining a low, a medium-low, a medium-high, and a high (optimal) potential for the achievement in the scientific, artistic, and everyday domain.

The four profiles could be used as reference tools to identify the individual potential for succeed within the three domains. Differently from the approaches that try to identify a

single gold standard measure to assess creativity or creative potential, we therefore propose a blend of variables, which, changing between the different knowledge domains, define the creative achievement levels. This approach indeed allows to take into account the complexity of the creativity phenomenon, which is composed by an ensemble of abilities and personal dispositions and traits, as well as the difference between different profiles in the phenomenology of this behaviour. Moreover, this approach is able to consider both the facilitator effect by some variable and the inhibitory effect by other variables in the creative achievement within the different domains (see for example the RAT effect on the scientific creative achievement).

The profiles can be considered as reference-based methodologies (where the reference is the creative achievement within the specific domain) to identify and measure the most important variables predicting creative achievement in the scientific, artistic, and everyday domains. Moreover, they can offer useful reference scores for the identification of the individual potential level to succeed in creative activities in the three domains. For these reasons, we proposed three short versions of the CREAM test battery to be used in the measuring of the creative achievement potential in the three domains. However, in the use of these referenced tools, the predictor weight of the single variable and the interactive effect between all variables indicated by the profiles should be considered. The complex interactive effects emerged between personality factors and convergent or divergent abilities show how creative achievement must be considered as a balanced blend of attitudinal and cognitive abilities, which measurement must necessarily consider both elements. The performance in a single creative test cannot therefore be considered sufficient to understand the creative achievement within a specific domain; on the contrary the measurement of a blend of specific variables emerged as predictors of creative achievement can at least be considered a good proxy of this multifaceted construct.

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