The **E**uropean
Collaborative
Creativity
Conference

Geneva
(Switzerland)

2nd Webster
Creativity
Week

June 17–19
2019

WCCI

MIC
MARCONI INSTITUTE
for CREATIVITY

EC³

Bologna
(Italy)

3rd MIC
Conference

June 20–22
2019

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3rd
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BOOK OF ABSTRACT

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Technical Program

Friday June 21

9.00   REGISTRATION

9.30	**KEYNOTE SPEECH** – Introduced by Giovanni Corazza
	Todd Lubart *(U. Paris Descartes)* — An individual differences approach to creativity from the 7 C's perspective

10.15	**SESSION 1** – Chair: M. Botella	**Creative cognition**
	<u>S. Weiss</u>[1], D. Steger[1], U. Schroeders[2], A. Hildebrandt[3], Y. Kaur[3] & O. Wilhelm[1] *[1] Ulm U., [2] U. of Kassel, [3] Carl von Ossietzky U.*	Origins of Originality - Dimensionality of Creativity and its relation with ability and personality
	<u>B. T. Christensen</u> & M. Friis-Olivarius *Department of Marketing, Copenhagen Business School*	The cognitive size of ideas
	<u>C. Rastelli</u> & C. Finocchiaro *Department of Psychology and Cognitive Science, University of Trento*	Semantic networks predict differences in fluid intelligence and divergent thinking among children
11.00	*Coffee Break*	
11.30	**SESSION 2** – Chair: A. Margaliot	**Innovative teaching for creativity**
	<u>M. Souza Neves-Pereira</u> *Dept. of Education and Developmental Psychology, Institute of Psychology, U. of Brasilia*	Investigating and developing creativity at school: a proposal by the cultural psychology of creativity
	<u>Libor Stepanek,</u> *Masaryk University Language Centre, CJV, Masaryk University*	Creative Approach to Language Teaching: Making Creativity an Integral Part of University Language Teaching and Learning
	<u>B. Le Hunte</u> *Faculty of Transdisciplinary Innovation, U. of Technology Sydney*	A curriculum for Being: Creativity for a Complex World
12.15	**SESSION 3** – Chair: T. Patston	**Design thinking and team dynamics**

	S. J. J. Abildgaard *Department of Marketing, Copenhagen Business School*	I Have an Idea! A Qualitative Study of Display of Individual Idea Ownership During Group Brainstorming
	J. P. A. von Thienen & C. Meinel *Digital Engineering Fakultät, Universität Potsdam*	Balancing Child-Like and Adult Approaches in Creative Pursuits: The Sense-Focus Model of Creative Mastery
	M. Canina, C. Bruno, & A. Salvo *IDEActivity Center, Design Department Politecnico di Milano*	Digital Creativity Tools Framework
13.00	*Lunch*	
14.00	**KEYNOTE SPEECH** – Introduced by Mathias Benedek	
	James C. Kaufman *(U. of Connecticut)*	Exploring Creativity's Positive Outcomes
14.45	**SESSION 4** – Chair: S. Rahman	**Dynamics in the creative process**
	W. Ross & F. Vallée-Tourangeau *Dept. of Psychology, Kingston University*	Microserendipity in the Creative Process
	M. Botella[1], J. Didier[2], J.Trouvé[1], M. Lambert, R. Attanasio *[1] Laboratoire Psychologie et Ergonomie Appliquée (LaPEA), U. Paris Descartes, [2] Haute Ecole Pédagogique de Vaud*	How can the observation of the dynamic creative process of pupils help them in their process?
	I.J. Ness *The Centre for the Science of Learning & Technology (SLATE), U. of Bergen*	Polyphony and Creative processes in the Classroom
15.30	*Coffee Break*	
16.00	**SESSION 5** – Chair: S. Mastria	**Physiological and cognitive insights on creative performance**
	M. van Dijk [1], E. Blom [1], E.Kroesbergen [2], & P. Leseman [1] *[1] Dept. of Education and Pedagogy Utrecht U., [2] Dept. of Psychology, Radboud U.*	Creativity: Towards a situated-embodied cognition perspective
	K. van Broekhoven, B. Belfi, & L. Borghans *Research Centre for Education and the Labour Market (ROA), School of Business and Economics, Maastricht University*	The effect of idea generation tasks on idea evaluation: A large-scale experimental study
	S. Agnoli *Marconi Institute for Creativity*	Looking in the eyes of the Muses: Eyetracking evidences on irrelevance processing
16.45	**SESSION 6** – Chair: L. Allison	**Creativity and innovation across cultures and domains**
	S. Rodrigues Kotz, & J. Farias Chagas Ferreira *Institute of Psychology at UNB*	The process of creativity in the context of social vulnerability, under the comprehension of cultural psychology

<u>C. Karnilowicz Mizuno</u>, & L. Xu *Faculty of Arts and Education , Deakin University*	Qualitatively Different Ways of Understanding Creativity: A phenomenographic investigation of Japanese Adolescents' Conceptualisations of Creativity in the Visual Arts
<u>Adelina Brizio</u>, Alberto Carpaneto, Marco Giachino, Alberto Robiati[1], Claudio Marciano[2], Monica Molino[3] *[1] Fondazione Human Plus, [2] U. of Aosta Valley Dept. of Economics and Political Science, [3] U. of Torino, Dept. of Psychology*	Innovative Behaviour. An empirical research in Italy
Massimiliano Palmiero[1,2], Paola Guariglia[3], and Laura Piccardi[1] *[1] Dept. of Life, Health and Environmental Sciences, U. of L'Aquila, [2] Cognitive and Motor Rehabilitation and Neuroimaging Unit, IRCCS Fondazione Santa Lucia, [3] Dept. of Human Science and Society, Kore University of Enna*	Music and divergent thinking: is only a matter of notes?

17.45   **KEYNOTE SPEECH** – Introduced by Roni Reiter-Palmon

Vlad Petre Glăveanu *(Webster U.)*	The possible: A theory

18.30   GUIDED VISIT TO THE MARCONI MUSEUM

19.30   SOCIAL EVENT AT VILLA GRIFFONE

Saturday June 22

9.00	REGISTRATION

9.30	**KEYNOTE SPEECH** – Introduced by Serena Mastria	
	Mathias Benedek *(U. of Graz)*	Cognitive neuroscience as a window on creativity

10.15	**SESSION 7** – Chair: M. Benedek	**Neuroscience of creativity**
	M. Stolte[1,3], E. H. Kroesbergen [2], Bob Oranje[3], & J. E. H. Van Luit[1] *[1] Dept. of Education and Learning Utrecht U., [2]Dep.t of Psychology, Radboud U.,[3]Dept. of Psychiatry University Medical Hospital, Utrecht*	'Gating in' Creativity: A study on the Psychophysiological Basis of Creativity in Primary School Children
	A. Di Crosta[1], S. Agnoli[2], S. Mastria[2], M. Palmiero[3], P. La Malva[1], A. Di Domenico[1], G. E. Corazza[2] *[1] Dept of Psychological, Health and Territorial Sciences, U. Chieti e Pescara, [2]Marconi Institute for Creativity, [3]Dept. of Applied Clinical and Biotechnological Sciences, U. of L'Aquila*	Unravelling the time course of idea generation: Effects of 10Hz and 40Hz tACS stimulations on the serial order effect in divergent thinking
	S. Mastria[1], S. Agnoli[1], M. Zanon[2], S. Acar[3], M. Runco[4], G. E. Corazza[1] *[1]Marconi Institute for Creativity, [2] DILL Department, University of Udine, [3]Buffalo State, The State University of New York, [4] American Institute of Behavioral Research & Technology*	Switching categories: brain activity underlying flexibility during idea production
11.00	*Coffee Break*	
11.30	**SESSION 8** – Chair: B. Le Hunte	**Creativity in education**
	T. Patston[1], D. Cropley[2], J. C. Kaufman[3] *[1]Geelong Grammar School, [2] School of Engineering U. of South Australia, [3]Neag School of Education, U. of Connecticut*	RISE – A new framework of Creative Education
	A. Margaliot & D. Gorev *Achva academic college, Department of Education*	What influences willingness to online collaborative learning of pre-service teacher after experiencing it?
	A. Valquaresma & J. L. Coimbra *Faculty of Psychology and Education Sciences,*	Creativity in a crossroad: the potential impact of education, creative self-efficacy and aesthetic

	University of Porto	judgment in establishing a complexity matrix for a contemporary understanding of the construct
12.15	**SESSION 9** – Chair: M. van Dijk	**Theoretical contributions to the science of creative thinking**
	A. Borges Formiga Sobrinho *Organizational Communication Department, Universidade de Brasília*	Purpose, the 7th P of creativity
	L. Allison *University of Lincoln, School of Design*	Ethnography as a Creativity Research Method
	P. C. Elton *Northcentral University, San Diego*	Creativity is Conversation?
13.00	*Lunch*	
14.00	**KEYNOTE SPEECH** – Introduced by James Kaufman	
	Roni Reiter Palmon *(U. of Nebraska)*	Team Social Processes and Team Creativity and Innovation
14.45	**SESSION 10** – Chair: M. Stolte	**Using and increasing creativity: interventions and tools**
	G. Fusi[1], M. Zanetti [2], E. Ferrari [1], L. Rozzini [2], A. Paladino[1], A. Antonietti[3], & M. L. Rusconi[1] *[1] Dept. of Human and Social Sciences, U. of Bergamo, [2]Dept. of Clinical and Sperimental Science, U. of Brescia, [3] Dept. of Psychology, Catholic University of Sacred Heart of Milan*	CREC (CReativity in Everyday life Challenges), a new cognitive stimulation programme for patients affected by Mild Cognitive Impairment: a pilot study
	R. Marrone[1] , D. Cropley[1], T. Patston[2], J. C. Kaufman[3] *[1] School of Engineering, U. of South Australia, [2]Geelong Grammar School, [3]Neag school of Education, U. of Connecticut*	Utilising Creativity-based interventions to develop positive attitudes towards Mathematics
	S. Rahman *NeuroCreate Ltd*	Symbiotic Design Approach Combining AI and Neuroscience to Spark Human Creativity
15.30	*Coffee Break*	
16.00	**KEYNOTE SPEECH** – Introduced by Vlad Glaveanu	
	Giovanni E. Corazza *(MIC; U. of Bologna)*	The Impossible: Leonardo da Vinci
16.45	**SESSION 11** – Chair: S. Agnoli	**Creative Education: Assessing creativity in class and in practice**
	M. McVeigh *Griffith Film School, Griffith University*	Screenwriting: Creativity and Creative Practice
	T. Patston[1] R. Marrone[2] , D.Cropley[1], & J. C. Kaufman[3] *[1]Geelong Grammar School, [2] School of*	Creativity predicts standardized tests above and beyond gpa

	Engineering, U. of South Australia, *[3]Neag school of Education, U. of Connecticut*	
	<u>D. Zbainos</u> & M. Koumpouni *Harokopio University, Department of Home* *Economics and Ecology*	Achievement goal orientations for creativity
17.30	**PANEL** – Chair: G. Corazza	**The future of research on creativity**
	Speakers:	R. Reiter-Palmon, V. P. Glăveanu, M. Benedek, J. C. Kaufman, I. J. Ness

18.15 BEST SPEAKER AWARD CEREMONY

18.30 CLOSING AND FAREWELL

Keynote Speech

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Friday, June 21, 2019
09:30 a.m.

Todd Lubard
Université Paris Descartes, France

An individual differences approach to creativity from the 7 C's perspective

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The field of creativity research is described using the 7 C's perspective: Creators (characteristics of creative people), Creating (the process), Collaboration (work in dyads or groups), Context (environment), Creation (creative productions), Consumption (adoption of creative goods), Curricula (training and developing creativity). For each "C", illustrative research focusing on individual differences will be presented.

SESSION 1

Origins of Originality - Dimensionality of Creativity and its relation with ability and personality

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Summary

Creativity is an ability that arguably is related to important life, school, academic and occupational outcomes. Since the early 1900s, over 200 different measurements—including divergent thinking tests, self- and others reports—were published and applied in inter-disciplinary research. Efforts to embed creativity into models of intelligence were made, however the distinction of creativity and general intelligence is still subject of debate. In study 1 (N = 142) we compared, based on a latent variable analysis, different test score models including various divergent thinking tasks for fluency and originality. The best fitting model is a bi-factor model including a nested factor of originality. In study 2 (N = 298) we enlarge the model series by insight and embed the bi-factor model in the nomological net of intelligence and personality. The findings implicate that fluency is moderately predicted by general intelligence, crystallized intelligence, and extraversion. Originality is not significantly predicted by either personality or intelligence. We discuss the findings in light of task requirement for originality and implications for further research.

Keywords: divergent thinking, originality, intelligence, personality, insight

I. INTRODUCTION AND AIMS

"After all is said and done, more is said than done" (Yamamoto, 1966). This statement is still up to date as researchers are still trying to understand creativity. Various studies cover the cognitive basis of creativity (Benedek, Könen, & Neubauer, 2012), its relation to processing speed (Forthmann, Hollling, Celik, Storme, & Lubbart, 2017), or personality (Batey & Furnham, 2006). Divergent thinking tasks have been widely applied as measures of creativity. However, there is still a discussion about the dimensions deployed in studies. Is the quality of ideas (i.e., *originality*) a better measure for creativity than simple idea generation or broad retrieval fluency? Where in the net of established abilities and traits is the creative ability?

Originality as a factor of Divergent Thinking. The implementation of originality tasks is in line with the bipartite definition of creativity as creative work is both clever, uncommon, as well as appropriate (Carroll, 1993). Because human ratings of originality tasks are time-consuming, a lot of studies report only fluency scores—justified by the high correlation between fluency and originality (r = .88, Torrance, 2008; r = .89; Silvia et al., 2008). Based on these correlations, originality and fluency are discussed as undistinguishable, sometimes resulting in the omission of the originality score (e.g., Ekstrom, French, Harman, & Dermen, 1976). Contrarily, originality, especially when only instructed for "being creative" (Nusbaum, Silvia, & Beaty, 2014), was shown to theoretically necessary and statistically distinct factor from fluency (Acar, Brunett, & Cabra, 2017; Carroll, 1993; Dumas & Dunbar, 2014).

We assume that originality is an important factor to measure creativity that can be distinguished from simple fluency tasks, although we expect both

factors to be highly correlated. In our studies, we use a variety of verbal and figural tasks for fluency and originality that are only instructed and rated for the intended domain, therefore we avoid statistical dependencies (Runco & Okuda, 1991). In study 1, we compare different test-score models of divergent thinking testing a series of latent variable models. We expect to find a specific originality factor nested in a general fluency factor. We aim to replicate the model series in study 2 and add an insight factor. In study 2, we embed the best fitting model in the nomological net of established abilities. Based on the above reviewed literature we expect a medium correlation with general intelligence (including working memory and speed), and small correlations with reasoning and crystallized intelligence. We also expect small positive correlations with Openness and Extraversion and a small negative correlation with Honesty-Humility.

II. METHODS

Sample. In study 1, the sample contained $N = 152$ participants after data cleaning, with a mean age of 23.4 years ($SD = 3.8$ years, ranging from 18 to 33 years). 54% of the sample are female. In study 2, the sample contained N = 298 participants after data cleaning, with mean age of 24.5 years ($SD = 5.1$ years, ranging from 18 to 49 years). 72% of the sample are female.

Measures. We employed a variety of creativity measures including measures for verbal and figural fluency, flexbility and originality (ETS Kit; Ekstrom et al., 1976; VKT, Schoppe, 1975). As a measure of insight, we applied anagram and scrabble tasks (VKT, Schoppe, 1975). All tasks were humanly coded based on the consenusal assessment technique (CAT; Amabile, 1982). As further covariates we assessed fluid and crystallized intelligence (BEFKI; Wilhelm, Schroeders, & Schipolowski, 2014), mental speed (Schmitz & Wilhelm, 2016), working memory (Schmitz, Rotter, & Wilhelm, 2018) and personality (HEXACO; (Moshagen, Hilbig, & Zettler, 2014).

III. RESULTS

Study 1. We computed a series of three models (g-factor, correlated factors, and bi-factor model). All models fit the data well. In the bi-factor model, the nested originality factor has low reliability and no significant variance ($p = .35$).

Study 2. We replicated the bi-factor model. An extended model—including intelligence and personality—obtained acceptable fit ($\chi^2(33) = 504.73$, CFI = .93, RMSEA = .04). The variance of the originality is significant ($p = .04$) although the reliability in the large model is still low ($\omega = .20$). Fluency is significantly predicted by general intelligence and crystallized intelligence. Insight is predicted by general intelligence. Speed is not predicting fluency or originality or insight significantly. Interestingly, fluency and originality are not significantly predicted by Openness. Only extraversion significantly predicts fluency. Originality is not predicted by any of the latent variables, fluency shows an $R^2 = .39$ and Insight $R^2 = .08$.

IV. CONCLUSIONS

We replicated previous findings on the relation of fluency and intelligence as well as personality. Interestingly, originality was not predicted by any of the covariates. Due to the low reliability of originality, we conclude that a broader measurement of originality complemented by a newer scorings (computerized scorings, quality scorings including cleverness, uniqueness and remoteness) might be necessary to assess originality (Forthmann et al., 2017, Forthmann, Szardenings, & Holling, 2018). Even though we avoid artificial correlations that may arise due to a method-bias, the nature of originality remains unclear and should be investigated in further studies.

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The cognitive size of ideas

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Keywords: Creative cognition; Ideation; Sticky notes; Brainstorming; Association; Limited capacity; Working Memory

I. INTRODUCTION

Both popular saying and theoretical conceptions would have us believe that ideas may vary in size, and be either 'big' or 'small'. The present set of studies examined the cognitive size of ideas at the moment of ideation. The purpose was to test the implications of models of ideation, and try to estimate the amount of information captured in each idea aspect, and test whether ideas differ from mere associations.

IDEATION

Classical theories of idea generation have mainly implicated associative memory in idea generation, but there is a growing consensus building that no single cognitive sub-system alone can explain creative productivity. Contemporary work highlights the central importance of working memory in making new connections and generating ideas (Hass, 2017; Nijstad & Stroebe, 2006, De Dreu, Nijstad, Baas, Wolsink & Roskes, 2012). The search for ideas in associative memory SIAM model (Nijstad & Stroebe, 2006) assumes that idea generation is a repeated search for ideas in associative memory, operating in two stages: first, a stage of knowledge activation takes place, followed by a stage of active and mentally taxing idea production. SIAM assumes two memory systems: a long term memory (LTM) that is assumed to be essentially permanent and with unlimited capacity, and a working memory, a temporary storage with limited capacity (Baddeley & Hitch, 1974).

The first stage draws heavily on the many parallels between idea production and free recall tasks, and is thematically related to Raaijmakers & Shiffrin's (1981) search of associative memory (SAM) model. LTM is in the SIAM model presumed to be partitioned into 'images' that are knowledge structures consisting of a central concept as well as features or associations of that concept. The second stage takes place in working memory. Idea generation follows a path of first activating knowledge in LTM, thereby temporarily storing an image in WM – it is assumed that only a single image may be activated at the same time (Cantor & Engle, 1993). In the second stage (in WM), features of the image are used to generate new ideas by applying knowledge or making associations, through an active search process. The problem definition serves as an important search cue in this regard. Given the limited capacity of WM, the model predicts that individual idea generation should be quite restrictive, with the implication that each idea produced should be of a very limited complexity (mainly altering features of a single image, or combining a single image with new elements). Such an account seems in sharp contrast with the magical 'springing fully fledged into mind' reported in phenomenological accounts of insight. The model further explicitly stipulates that ideas are to be thought of as distinct from associations. While associations are connections between or within images that may not require much WM capacity to retrieve in free recall, ideas are the WM taxing active search and manipulation of images under a set of task constraints and available search cues.

II. METHODS

STUDY I

Brainstorming remains heralded as the most frequently employed creative method amongst both novices and experts (Goncalves, Cardoso & Badke-Schaub, 2014). The stick-'em-up brainstorming variant (using a sticky note to write down each individual idea and 'sticking them up' on a surface such as a white board) is probably the most popular version today. Sticky notes may be used as a window into the cognitive processes in idea development, in that they are used to externalize and capture ideas in creative work.

Thirty-eight university students (22 female) participated in a facilitated stick-'em-up brainstorming exercise. The purpose of the task was to generate ideas for a new business model for a credit card company with a large customer base, but with a non-sustainable business model. The students worked in 10 groups of 2-6. The groups were instructed to follow the standard principles of brainstorming: Avoid critiquing and evaluating ideas; strive for quantity of ideas; seek the wild ideas; build on each other ideas. They then participated in stick-'em-up ideation using sticky notes for 20 min.

In order to control that the size of the sticky note did not affect the amount of content, each group worked with two distinct sizes of sticky notes in their ideational production: the standard 76 x 76 mm square sticky note, and the larger 76 x 127 mm rectangular sticky notes. The brainstorming resulted in a total of 867 sticky notes produced across the 10 groups (range 37-183 per group; individual range 5-79, mean = 22.8). For analysis, each sticky note was transcribed and coded for its textual and pictorial content.

As a first validity check that the size of the sticky note itself was not affecting the cognitive size of the produced ideas, we compared the amount of content on the two sizes of sticky notes employed within the groups, and found no significant difference between the two sizes for: amount of words, type of linguistic components, or the number of ideas produced per person or in total.

We then counted the number of words placed on each sticky note to get an estimate of how big the average idea is. The average number of words placed on a sticky note was 3.8 (SD: 2.8, range: 0-21). The most frequent word count on a sticky note was the entry of a single word, with more than half of all sticky notes containing 3 words or less, and 95% of sticky notes containing 9 words or less, illustrating that the ideas produced rarely covered more than a fraction of the complexity contained in the problem statement.

The problem statement is complex in that it requires a new type of business model for an existing organization (a credit card company) as a solution. The vast majority of ideas addressed only aspects of the overall problem, or were constituted by singular constructs that seemed to serve mainly the activation of a concept into the problem space. In approaching such a complex problem, it appeared impossible to ideate more than simple connections between smaller parts at any one time.

In support of predictions from the SIAM model, it thus seems that the initial ideational production towards the solution of a complex problem was of limited size. Assuming that sticky note content in idea generation mirrors creative cognitive structures, it seems clear that ideas are of very limited size – about 3 to 4 words on average - covering 1-2 main constructs that are only sometimes manipulated or actively connected through verbs. This observation then begs the question of whether ideational production then differs from mere associations, as theorized by the SIAM model? A first observation is that while approximately 25% of all sticky notes contained only a single word, the remaining 75% covered additional content, suggesting that the vast majority of sticky notes pertained to more than a singular associative connection.

STUDY II

To show more firmly that associations differ from ideational production, we experimentally tested whether asking for ideas or associations produce different results, using the Alternative Uses Task (AUT). The AUT is one of the most common approaches to the study of idea generation and divergent thinking, and involves asking subjects to generate alternative uses of a common object such as a brick. We compared the normal AUT instructions with an altered set of instructions asking instead subjects to list 'associations of a brick', and then compared the resulting output, with more than 10 000 ideas or associations generated across subjects.

On average, ideas consisted of approximately 3 words (similar to our findings in the present chapter), compared to an average of just over a single word for associations. 90% of associations consisted of a single word (typically a single noun or a single adjective), compared to 43% of ideas being single words. Conversely, ideas much more frequently than associations contain verbs (61% vs 6%) or adverbs (19% vs 0.1%). Ideas also much more frequently than associations contain more than one noun (e.g., in conceptual combinations) (14% vs 4%). All differences were highly significant. To sum up: in alignment with the predictions of the SIAM model, ideas have a very limited cognitive size, containing only aspects of any complex problem statement. However, ideas are distinctly more complex than mere associations, and include manipulations of images or combinations of concepts.

III. CONCLUSIONS

Our results support predictions from the SIAM model: that idea generation involve both associations drawn from LTM as well as imply operations in a WM with limited capacity. The implication is that ideas should not come fully formed, but rather be of quite limited size, albeit somewhat larger than mere associations. Our results support this view – that a central engine in ideational production is capable of bursting out multiple small disparate (although not necessarily disconnected) ideas in the form of simple image manipulations or small-scale conceptual combinations.

If we consider each idea it then seems to arrive in a quite limited size, covering only fragments of any complex problem addressed, but simultaneously significantly different from mere associations. Ideas are beyond associations – they involve the application of mental operators manipulating the concept in question; they combine concepts; and they often imply some (albeit limited) structure.

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Semantic networks predict differences in fluid intelligence and divergent thinking among children

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Summary

Keywords: Creative Cognition, Divergent Thinking, Fluid Intelligence, Semantic Memory, Network Analysis, Children, Language, Small World.

I. INTRODUCTION

Creativity is central to cognition enabling progress across all the knowledge domains. The traditional definition conceives creativity as the capacity to produce ideas that are both novel and useful. Despite the relevance of creativity for human development, we still lack essential knowledge about how creative thinking occurs and what makes some people more creative than others. Theory suggests that creative ideation follows a principle of economy, the best solution between two concepts is the one which minimizes the amount of information necessary to produces the best response (Gabora, 2018). Current theories of creative cognition propose that the creative ideation relies on two competing subcomponents that alternatively generate and select solutions to ill-posed problems. One subcomponent is a bottom-up process regarding the generation of novel ideas and is related to divergent thinking (DT) and to the flexible properties of the semantic memory (Mednick, 1962). The second subcomponent is a top-down process involving the selection of appropriate ideas and it is related to convergent thinking, executive functions and fluid intelligence (Gf) (Benedek et al., 2014). However, the specific contribution of fluid intelligence and divergent thinking to ill-posed problems remains an open debate. In this study, we investigated how fluid intelligence and divergent thinking are related to the structure of semantic memory from a network science perspective in children. We examined the semantic memory represented as a network, having concepts as nodes and links to indicate semantic similarity among those nodes (Collins and Loftus, 1975). Network science methods allowing us to quantify the role of a semantic memory structure in creativity at the cognitive level. One of the models developed in network science mostly used to examine complex systems is the Small World Network model (SWN; Watts and Strogatz, 1998). The main features of SWN include: the clustering coefficient (CC) as a measure of the probability that two nodes close to a single node will be themselves close; the Average Length of the Shortest Path (ASPL), which is the quantity on average shorter steps between two pairs of nodes; the modularity index (Q), which allows to quantify how much a network is divided into subgroups; finally, the "small world-ness" measure (S) can be considered an index of network's efficiency. Thus, characterized by high local connectivity (higher CC) and short global distances between nodes (lower ASPL), a SWN allows efficient diffusion of activation and information retrieval. In order to construct the semantic networks, we collected the participants' responses in a semantic verbal fluency task. This task involves two distinct processes: clustering, concerning word retrieval within a sub-category, and switching as passing from one sub-category to another when the former runs out (Troyer, 2000). Recent studies suggest that participants with higher performance in DT and Gf

tests move from one category to another more often (Kenett et al., 2016). Therefore, the more the switching during the task, the more the lexical network will be structured and modular. However, according to the results obtained in other research (Kenett et al., 2014) we could expect that: the high-Gf group's networks will be more structured (longer ASPL and higher Q) than low Gf group. Moreover, the high DT network will be less structured (shorter ASPL and Q) and more efficient (higher S) than the low DT groups.

II. METHOD

A pool of 54 participants (mean age = 10.05, SD = 0.27, 55% male) took part in the research. Measurements were collected at school in usual class hours. The study protocol has been approved by the Human Research Ethics Committee of the University of Trento and all the participants gave approval and written parental consent. The *Word Semantic Fluency* test was used to assess lexical access ability. According to standard procedure, participants had one minute to generate as many animal category members they could think of. *Fluid Intelligence (Gf)* was assessed using the Standard Progressive Matrices (SPM; Raven, 1958) as a measure of inductive reasoning. The test is composed of 60 items divided into 5 series. Each item requires to complete a series of figures with the missing one, compared to a presented model and according to a criterion of increasing difficulty. The Alternative Uses Task (AUT; Guilford, 1967) was used to evaluate the ability to generate multiple alternatives and solutions. Participants were asked to generate as many unusual uses for the object "brick", in 3 minutes. *Fluency* scores were based on the total number of ideas reported and *Flexibility* was measured by the number of solution-categories. Moreover, two raters performed the creativity scoring evaluating each response following the Guilford's notions of creative ideas as uncommon, remote, and clever as instructions. Each response received a rating on a 1 to 5 scale. With the purpose to construct the *Creativity Index* (Silvia et al., 2008), all response were averaged. A high degree of reliability was found between the measurements. The average measure ICC was

.76 with a 95% confidence interval. Finally, the *Divergent Thinking (DT)* results as a mean of the total AUT scales.

III. ANALYSIS AND RESULT

In order to include all the participants in the sample, participants were divided in two groups (low vs. high) based on the median of either DT and Gf score. While the two groups differed significantly as the two independent variables (Gf/DT) they did not differ significantly in age, vocabulary knowledge and written word per minute.
Network Analysis The semantic fluency data were analyzed implementing a recently developed network science approach (Kenett et al., 2013). In this network, nodes represent the category members and edges represent word correlations, or the tendency of the sample to generate a word "b" given that a word "a" is generated. In order to analyze the data, we converted the responses for each group into data matrices, in which row contains the answers of a single (DT/Gf) subject, and each column represents a unique animal name given by the entire sample. Thus, a word-correlation matrix between all pairs of words generated in each group was created using Pearson. Finally, the networks were filtered and edges were binarized to create in output the unweighted and undirected networks. Results from the network analysis revealed differences between levels (low/high) of either Gf and DT networks. Particularly, the high Gf group showed longer ASPL (3.22) and higher Q (0.60) and almost similar S (5.02) compared to the low Gf group (ASPL = 3.11; Q = 0.57; S = 5.04). Thus, the high DT group showed shorter ASPL (2.09), Q (0.43) and higher S (2.74) compared to the low DT group (ASPL = 2.21; Q = 0.40; S = 2.36). Indeed, the low DT network appeared to be more spread out and more structured than the high DT networks. Moreover, the high DT group's network was less structured with a more flexible structure, as shown by the higher S measure (4.72). To statistically examine our results we applied bootstrap analysis, randomly selecting half of the nodes from each group networks. We chose 1000 iterated samples for all measures (ASPL, Q, and S) and applied an independent t-test of these

measures for each partial bootstrapped network. While the differences for all that measure were numerically small, all the comparisons were statistically significant (p = < 0.001).

IV. CONCLUSIONS

In the present research, we respectively compared low and high Gf and DT groups to shed light on the properties of the semantic networks that have an impact on children creative cognition. The comparison between the networks of the two groups revealed several differences that demonstrate the relationship between Gf/DT and the lexical structure of the animal category. Taken together, the results confirm that even in the development population, fluid intelligence corresponds to a more structured lexical network, while divergent thinking affects the flexibility structure of the lexical network. This outcome corroborates network science as a method to study creativity and intelligence in the developmental population.

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SESSION 2

Investigating and developing creativity at school: a proposal by the cultural psychology of creativity

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Keywords: Creativity, Dual Process, Shifting, Thinking Types, Analytical Thinking

I. INTRODUCTION

It has been suggested that creative outcomes may vary as a function of the ability to shift between generative and evaluative thinking processes. A key aspect of creative idea generation is forming associations between different objects, concepts and memories. Thus, in order to separate and explore the sub processes involved during creative thinking and their interaction, in this study, we focused on evaluative and associative thinking processes. Furthermore, it may appear as though generative and evaluative processes correspond to Type 1 (heuristic, associative) and Type 2 (analytic, working memory-based) thinking. However, it has been suggested that both Type 1 and 2 processes are involved in evaluation and generation (Allen & Thomas, 2001) emphasizing the potential importance of understanding the nature of the interaction between these different processes (Sowden, Pringle & Gabora, 2015).

In order to evaluate the possibility that the shifting process itself is predictive of creative outcomes, it is first necessary to develop tasks that separate the associative and evaluative sub-components of the creative thinking processes so that they can be examined both individually, and in combination. This was the goal of the present work.

II. METHODS

We adapted the alternate uses task (AUT: Guilford et al., 1978) by devising three conditions.

1. In the *Associate* task, participants were presented with a series of nine common objects and for each, they were required to <u>generate</u> one item that they automatically associate with the given object (e.g. associate a *knife* with a *fork*). They were not asked to evaluate the use and the response did not have to be creative.

2. In the *Evaluate* task, for each of nine common objects presented, participants had to judge whether this object could be used in an alternative way (i.e. use a *CD* as *plate*). Therefore, generation was not involved in this task but the use had to be <u>evaluated.</u>

3. In the *Create* task, participants had to provide a creative use for each of the common objects presented. Participants were encouraged to be creative and informed that creative uses would typically be 'new, unusual and clever'. To perform this task successfully participants would have to both <u>generate</u> and <u>evaluate</u> ideas.

Participants were scored for response time for the three tasks. Also they were scored for accuracy (whether they correctly endorsed actually plausible alternate uses) for the *Evaluate* task and originality for the *Associate* and *Create* tasks. Originality was scored

following Runco, Okudo and Thurston's technique described in Zenasni and Lubart (2008), which requires calculating each response's relative frequency within the sample by dividing the number of respondents generating that idea by the sample exposed to that stimulus and subtracting the result from one.

We explored the relationship between performance on these tasks (both originality/accuracy and response time) and a variety of measures related to creativity. The predictors were the following: Self-perceptions of creativity, measured using the Kaufman Domains of Creativity Scales (Kaufman, 2012); Divergent thinking, assessed by the Just Suppose task from the Abbreviated Torrance Tests for Adults (Goff & Torrance, 2002); Rational and experiential thinking, assessed by the Rational-experiential Inventory (REI) and the Cognitive Reflection Test (CRT) used to measure the tendency to favor analytical versus heuristic thinking (Pacini & Epstein, 1999; Frederick, 2005).

In addition, using a new self-report scale (Pringle & Sowden, submitted) we measured participants' competence at shifting between associative and evaluative thinking processes and their meta-cognitive awareness of this shifting process. Participants were scored for Shifting Awareness, Shifting Competence and Simultaneous use of associative and analytic processes (Simultaneity) and these were also predictor variables.

Finally, we controlled for the influence of the personality trait Openness, along with participant's verbal fluency and IQ using the Big 5 Inventory (John & Srivastava, 1999), the 3-letter Verbal fluency task outlined by Phillips, Bull, Adams and Fraser (2002), and a short form of the Raven's Progressive Matrices (Raven & Court, 2004) respectively. A preliminary correlation explored the relationship between these different measures, and hierarchical linear regressions explored their ability to predict performance at the three experimental tasks. Furthermore, we conducted a MANOVA in order to investigate what

discriminates high and low creative participants based on high and low score on the K-DOCS.

III. RESULTS

In order to validate the novel paradigm, hierarchical linear regressions were conducted to investigate whether the established measures were predictive of the three tasks: Associate, Evaluate and Create. Firstly we inserted the three control variables then, for the second model we added all the predictor measures (see method section). Supporting our hypothesis, only Create was predicted by established measures, whilst associate and evaluate processes individually were not predicted by measures of creativity. Higher intelligence, Shifting Awareness and analytical thinking were predictive of longer Create response time; also intelligence and divergent thinking were both predictive of Create Originality.

Create response time significantly predicted by IQ, Shifting Awareness and CRT score with an initial $R^2 = .072$, $p = .02$ in the first model and a $R^2 = .252$, $p = .02$ in the second model.

Create Originality. Both IQ and ATTA Originality, significantly predict Create Originality, with initial $R^2 = .063$, $p = .04$ increased to a $R^2 = .098$, $p = 0.03$ in the second model.

We were also interested in investigating what discriminates high and low creative participants split based on K-DOCS scores.

MANOVA indicated that higher creative individuals in our study are distinguished by their personality trait openness, divergent thinking abilities, tendency towards rational thinking and competence at shifting between thinking processes. Openness $F(1, 146) = 63.7$, $p < .01$ partial $\eta^2 = .304$; ATTA Fluency $F(1, 146) = 8.6$, $p < .01$, partial $\eta^2 = .056$; ATTA Originality $F(1, 146) = 9.6$, $p < .01$ partial $\eta^2 = .062$; Rationality $F(1, 146) = 13.81$, $p < .01$ partial $\eta^2 = .086$; Competence $F(1, 146) = 11.2$, $p < .01$ partial $\eta^2 = .071$.

In summary, our results suggest that our measures of association, evaluation and

creation capture distinct processes. It's worth noting that shifting competence significantly differentiated high and low creative participants, supporting the existing evidence that shifting plays a key role in creative thinking and, therefore, is an important avenue of investigation.

IV. CONCLUSIONS

Overall our findings demonstrated that the measures adopted in this study presented good concurrent validity with established indices of creativity. Divergent thinking was predictive of the single response, create task, confirming its validity. As expected, none of the creativity measures were predictive of either evaluative or associative tasks. These routinely accessible processes, taken separately, appear to be distinct from their combination when thinking creatively, as captured within the *Create* task. Interestingly, intelligence and analytical thinking were also predictive respectively of originality and response time on the *Create* task. This provides support for the generally accepted notion that divergent thinking is a necessary but non-sufficient component of creativity.

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Creative Approach to Language Teaching: Making Creativity an Integral Part of University Language Teaching and Learning

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Summary

This paper presents Creative Approach to Language Teaching (CALT) as an effective alternative to conventional university language teaching approaches and addresses some central questions of creativity in teaching and learning of languages. It addresses CALT from two perspectives: its theoretical principles, and the impact of action research on teaching and learning. The aim of this presentation is to offer a practice-oriented insight into CALT and highlight its potential to broaden methodological repertoires of language teachers; to improve individual learning styles of language learners; and to bring language classes closer to authenticity.

Keywords: creativity, language teaching, language learning, teacher training, university education, Creative Approach to Language Teaching (CALT), authenticity

I. INTRODUCTION

This paper presents Creative Approach to Language Teaching (CALT), a method based on the notions of the failure of conventional education to reflect authentic needs of learners (Collini, 2012) and natural creativity in language use (Clarke, 2010), and addresses CALT from the perspective of its theoretical background and action research findings.

The theoretical baseline shows the use of creativity-related theories and approaches, such as Robinson´s organic system curriculum change, Csikszentmihalyi´s system models, or de Bono´s lateral thinking, for the development of the CALT definition of creativity. The action research shows ways the CALT-based methodology was implemented in courses and individual activities, and its impact on teachers and learners.

Our findings indicate that CALT has the potential to influence individual activities, interconnected series of tasks, syllabi or the whole approach to teaching and learning. Teachers using CALT seem to emphasize their roles of facilitators of language learning who share negotiated responsibilities with learners in the community-of-practice style and tend to create more flexible and dynamic learning environments. Students engaged in CALT, on the other hand, seem to enjoy their new position of co-authors and co-creators of their own learning.

The aim of this paper is to offer a detailed, practice-oriented insight into CALT and highlight factors that can offer broader choice of tools to teachers; a great variety of learning styles to learners; and more authenticity to language classes.

II. METHODS

CALT is based on theoretical study and action research. Theoretical baseline results

from a literary review of creativity theories and research. Potential suitability for application in language teaching and learning of the studied theories was considered and a definition of CALT was created. It sees creativity as a natural function of intelligence of every individual that takes many forms, has different levels, finds different uses and draws from a variety of capacities. Instead of being a result of teaching, creativity is produced by the right combination of group or personal characteristics and an encouraging environment. (Csikszentmihalyi, 1996, Heindel and Furlong, 2000, Robinson, 2009, Runco et al., 2010, Torrance, 1970, Treffinger et al., 2002).

The CALT method was implemented in action research in a variety of courses and training workshops. A total of 292 university students enrolled in 30 seminar groups in ten different one-term courses in twelve terms (Autumn 2009 - Autumn 2015) and 87 teachers took part in one/two day teacher training workshops in the 2011-2018 period. All the student courses were organised at the Masaryk University Language Centre, in Brno, Czech Republic, the teacher trainings were held at universities in the Czech Republic, Slovakia, Germany, UK, Spain, Italy and Argentina. The participants included individuals from culturally, nationally, linguistically and academically diverse communities. At the end of each course, participants were engaged in giving feedback.

FINDINGS

The research findings suggested that the range of CALT activities in language classes that have potential to enhance creativity and learning is relatively broad. General characteristics of the activities are: effective use of the learners´ existing knowledge and skills; absence of situations that invite right/wrong answers or correct/incorrect solutions; the right combinations of in-class and out-of-class tasks, technology low and ICT-enhanced activities, didacticised and

student-generated sources, linguistic and transversal soft skills; and space allowing presentation of barriers to creativity and ways to deal with them. Concrete examples include web-quests; creative fluency and flexibility tasks, film-based grammar, or flexible syllabus.

Course and workshop feedback confirmed satisfaction with the CALT methods (67% of participants thought the courses were better than they had expected and 72% would recommend the courses to their peers). Detailed answers in the "I have learnt" section (despite the fact the courses were focused on language) included reactions such as: *"... Barriers of my own thinking, possible strategies to overcome them, some of my strengths and weaknesses; ...that even I could be creative; ...how to work with my fears,...; ...useful for my life in general: Everything has got some solution. Nothing is impossible. ... I have learnt mainly group dynamics, have improved English...;...learned to distinguish some type of thinking. ...; ...it was not boring studying, but full of information and useful lessons; ... I liked that there is no reason to have a fear of making mistakes.; ...possibility of practice English simultaneously with learning new thing about critical thinking with practical experience..."*. (Stepanek, 2015)

III. CONCLUSIONS

This paper presents Creative Approach to Language Teaching as an effective alternative to conventional language teaching approaches and addresses some central questions of creativity in language teaching and learning. CALT, in the form of organisational approaches and pedagogical methods, syllabi, courses and sessions, or individual tasks and activities, can encourage variability and flexibility of language education and foster autonomous learning. It supports the notion that creativity is a type of intelligence all learners have and offers a style of creative teaching that elicits creativity from learners. It engages them in authentic or close-to-real-life situations and problems that cannot be solved

by one potentially automatic clear-cut, correct solution, increases learners´ contribution to language classes and helps them bring and share their existing knowledge and skills to class.

In the future, finding balance between CALT and non-CALT methodologies in different types of language courses could improve effectiveness of language learning in general.

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A curriculum for Being:
Creativity for a Complex World:

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Summary

Keywords: Creativity, complexity, social change, systems thinking, curriculum for being, transformative education, connectivity

I. INTRODUCTION

Steve Jobs famously claimed that creativity is about making connections. And in a world that is more open, complex, dynamic and networked than ever before in human history (Dorst, 2018), we could say that understanding this connectivity should become the central enterprise of any educational institution attempting to find creative solutions for the challenges and opportunities we face today.

For example, you cannot study the health of our population without understanding the impact of our education system on our health, or our ecology, agriculture, medical sciences, marine biology, the media, and so on. Any change made in one of these layers or nodes of the system will impact on all others in ways that are impossible to predict. Nonetheless, today's university student will generally study only one of these disciplines, usually in isolation, and often with a neo-liberal agenda that prepares students for an unsustainable future or for jobs that will no longer exist. There is little or no creative thinking put into understanding creative, connected thinking in education.

Schools, too, silo our disciplines as if they have nothing in common. The liminal spaces 'betwixt and between' fields (Turner, 1967) are a no-man's land, yet these liminal spaces are ripe for creativity and discovery, with predictions that they will be the fertile areas for future discovery (Johansson, 2014)

This study describes an award-winning attempt to combine 25 different undergraduate degrees with a single degree – the Bachelor of Creative Intelligence and Innovation at the University of Technology Sydney. This extremely popular transdisciplinary degree cannot attempt to teach deep knowledge to students in each of the 25 disciplines it combines. Rather, it privileges Being rather than Knowing – ontology not just epistemology (Barnett,2012). The value of a Curriculum for Being is explored as a way to find unity in our diversity, making it a model for the new uni-versity where inner and outer knowledge must combine.

COMPLEXITY IN EDUCATION

Whilst we think of individual learning taking place within an educational system (which learns and evolves), the Academy sits within broader systems that are also learning and evolving, including our state, nation and world, which simultaneously interact with all other living systems that are learning and adapting to co-exist. Culturally, ecologically, conceptually, these sense-making systems are intertwined and respond to each other in a creative fashion, and as such require a creative response. To separate these distributed and diffuse systems into parts, according to some, is an act of violence. 'The opposite of complexity is not simplicity. It is reductionism.' (Bateson, 2019)

How then do we create an education system that isn't reductionist, but rather utterly expansive, where creativity plays a central role?

CREATIVITY IN EDUCATION

How do we avoid giving students a reductionist education in a singular discipline that clings to the safety of its historical, retrospective boundaries? The idea proposed here is that we look at creativity as a way to respond to complexity – looking at its capacity well beyond any single discipline – looking at creativity as a way to probe rather than predict. To engage rather than freeze. To play rather than work. To trust rather than fear. To connect rather than dissect.

The dissection of knowledge into a variety of disciplines is one of the reasons so many of our systems are stuck. Climate science, on its own, tends to be a process of 'monitoring our extinction' rather than improving our chances of survival – many more players in our system are needed if we are to address the problem in its fullest context. Indeed, disciplines, when separated into discrete domains, can rarely take action to tackle wicked problems. 'Most actions, if they are eventually taken, tend to focus on back-end, shallow, reactive, short term, single-factor, heavy-handed, de-contextual initiatives.' In response to this stuckness, one of the solutions proposed is 'transformative education.' (Hill, 2019)

I would suggest that there is no such thing as a transformative education without the inclusion of introspective as well as action-based creativity. Introspective, because it can help us understand our individual creative agency in a complex world – and action-based (often through collaboration) because we cannot remain paralysed in the face of complexity and the massive challenges we face.

Creativity is at the pulsing core of all our disciplines, all our discoveries – so it plays an important role in generating new knowledge and pushing out the boundaries of our fields. This diversity at the bleeding edges of discovery is essential, but so, too, is the core or source of creativity – the place from whence it radiates outwards. This creative source can exist in an institution (the unity in the uni-versity) and in a curriculum. (The Bachelor of Creative Intelligence and Innovation is a degree that sources a unified field of knowledge to share between all individual disciplines).

Significantly, however, it also exists in the individual. Hence a creative education should also focus on Being (ontology) not just Knowing (epistemology). There is a Vedic notion that there are many knowledges but only one knower. This site of knowledge is simultaneously located in the knower and the core of the university, as well as in the unifying principles of the curriculum. Realised on this level, it becomes a thing of 'profound simplicity,' rather than a reductionist simplicity that does a disservice to its object of study.

A CURRICULUM FOR BEING

This abstract alludes to the potential of a Curriculum for Being to deliver transformative education – and it has mostly stated the 'why' rather than the 'how' of such a curriculum. However, my talk (and the paper that will follow) articulates how this curriculum has evolved in the context of a world-first transdisciplinary degree.

Case studies of a full range of creative methods for delivering education will be explored – from thought experiments to straw man proposals to think tanks, complexity storytelling, data visualisation, dragon's dens, methods sandpits, etc. Whilst touching on traditional research in creative educational delivery, such as Lombardi's work on authentic Learning, Barrows' work on Problem Based Learning (PBL) or Design Based Learning as practiced at Stanford's D.School, this work addresses the notion of how the self is created by responding to the creativity of individuals, organisations and living systems as we all continue to learn in relatedness. Indeed, the theme of this talk is very much about relatedness and its integral role in the building of a Curriculum for Being. The research method for a Curriculum of Being is based on action research for transformative change (Ison, 2008), and allowing students to pursue what is most meaningful to them (Checkland, 2000).

I also invite collaborators to speculate and contribute to a vision of what a universal creative curriculum might look like if it were to exist in an interactive, networked, global context that defies any notion of a university as we have currently understood the term.

II. CONCLUSIONS

As early as 2010, IBM's global CEO survey surfaced concerns that the world was becoming too complex to negotiate – that tools were missing from the toolbox that had been trusted thus far. Creativity was seen as the single-most important management trait for our organisations to thrive. Understanding and teaching creativity, then, should become an integral part of every educational institution. This requires us to not only transform our educational institutions, but to offer within them a transformative curriculum. It also requires us to work together in imagining how such a curriculum could transcend disciplines, educational institutions and national borders.

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SESSION 3

I Have an Idea! A Qualitative Study of Display of Individual Idea Ownership During Group Brainstorming

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Summary

This study investigates displays of ownership over individual ideas on sticky notes in group brainstorming. Ownership of one's own idea is an issue that most of us are familiar with when generating ideas in a team. We tend to think of an idea we produce as our idea and thus refer to the idea as something belonging to ourselves. However, in collaborative idea generation sessions, such as brainstorming, the aim is to transform the individual ideas into refined and complete ideas – and most important - shared ideas. To come closer to understanding the role of idea ownership, ten groups of university students engaged in facilitated brainstorming sessions were studied. The analysis shows that idea ownership is present in the brainstorming sessions, but given the way in which the participants' orientations to the rules of brainstorming, expressed idea ownership does not cause internal conflict in the group or influence the course of ideation in a specific direction.

Keywords: brainstorming; ideas; ownership; collaboration; creativity; teams; sticky notes

I. INTRODUCTION

The individual idea, as a basic element of one's thought, is generally brought into a group through verbalization or in writing, also described as externalization (Dix & Gongora, 2011). In a group brainstorming session, as one of many creative methods of generating ideas, the individual member's idea enters into the continuous growing collection of ideas from the participating members and form a pool of (what is considered) shared ideas. In this setting, feelings of ownership of one's ideas may arise and potentially cause conflict, despite the very outset of rules of brainstorming such as suspension of judgment, critique, and building on other's ideas (Osborn, 1957).

This study aims at answering the question of *if,* and if so, *how* the feeling of psychological ownership over individual ideas is displayed through communicative resources during a collaborative idea generation session such as brainstorming? Moreover, what role does idea ownership play in this setting?

BRAINSTORMING AND STICKY NOTES

Idea generation has become increasingly popular to study in the field of creativity research and design research. One method for idea generation is brainstorming, which typically involves social interaction, where individual participants produce ideas on sticky notes and share them in a group in order to come up with creative or novel solutions to problems (Paulus & Brown, 2007). Alex Osborn (1957) was the first to describe free-flowing idea generation as 'brainstorming'. Different variations of brainstorming exist, but in most cases, these variations are based on Osborn's basic rules. They entail suspending critique and judgment, encouraging wild ideas (divergence), aiming for quantity, building on other participants ideas, and allowing for idea

presentation without interrupting the speaker (Matthews, 2009; Osborn, 1957).

This study focuses on the dynamics of social interaction during facilitated brainstorming sessions within ten groups of university students. Sticky notes are analyzed from a multimodal perspective as one out of several semiotic resources (e.g. talk, gesture, gaze, body posture, pointing, whiteboard markers), which the participants employ during brainstorming. The sticky note is understood as a physical container for the individual idea and viewed as a baton for sharing the individual ideas between the members in the groups, while also enabling collaborative idea construction, idea continuation, and serves as inspiration and visual cue for new ideas (Dove et al., 2017).

Idea Ownership

The theoretical framework in this study draws on the concept of ownership as a cognitive-affective state, i.e. different from ownership of things or property, reflecting both the individual's awareness and beliefs concerning the target of ownership (cognitive), and the emotional sensation i.e. the pleasure of ownership (affective) (Pierce, Kostova, & Dirks, 2003). The psychological ownership can be defined as "that state where an individual feels as though the target of ownership or a piece of that target is "theirs" (i.e. it is MINE!)" (Pierce et al., 2003, p. 5). Individuals can develop this feeling for objects that are both material (products, space etc.) and immaterial (ideas, social roles etc.) (Baer & Brown, 2012).

Moreover, the interest in this study is observing how expressions of idea ownership may be displayed through communicative resources i.e. verbal or non-verbal elements, which the participants employ through communication and sense-making (Goodwin, 2006).

II. Methodology

To investigate in detail the display of ownership of ideas during the group brainstorming sessions, the study applies ethnomethodological conversation analysis (EMCA) as a theoretical and methodological framework, where video recordings serve as the empirical fundament. EMCA is a qualitative analytical approach, that has been used in several investigations into designers' work and design processes (e.g. Button & Sharrock, 2000; Luff & Heath, 1998; Matthews, 2009; Oak & Lloyd, 2016). Unlike conducting interviews or controlled laboratory experiments, video recordings allows for a non-intrusive examination of the same fragment of interaction repeatedly and in detail (Heath, Hindmarsh, & Luff, 2010).

The data consist of 4 hours of video recordings of ten brainstorming sessions (of 20 minutes) conducted the same day. 38 university students (22 female and 16 male) participated in the study as a part of a master course in creativity and innovation at a Danish university. The students were divided into ten groups of 2-6 participants. Facilitators were present during the ten brainstorming sessions instructing in Osborn's rules of brainstorming (1957).

III. Results and Conclusion

The results indicate that idea ownership rarely follows an "ownership" schema (i.e. the idea proposal is verbally designed as "my idea is…"). However, the findings suggest that idea ownership may, in fact, be displayed through idea proposals of possessive character i.e. "I have …" or "I'll take …". The linguistic analysis showed that the most frequently used format for idea proposals entailed the pronoun "you", a format which refers to a generic "you" as opposed to a specific pronoun. The analysis did not identify a noteworthy amount of disaffiliated responses on idea proposals (such as critique), arguably since the rules of brainstorming influences the proportion of expressed idea ownership, and because the facilitated structure of brainstorming creates a certain social order where ideas are presented turn-by-turn and critique are thus avoided in most cases.

The rule "defer judgment" appeared to resonate with the interactional order amongst the participants across all ten brainstorming sessions. This supports the ideal behind the rules of brainstorming namely the collaborative or shared idea generation, where certain

instructions reduce, or as the present study finds, minimize idea ownership in favor of the common goal to share ideas amongst a team in order to co-produce ideas that are innovative and original.

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Balancing Child-Like and Adult Approaches in Creative Pursuits: The Sense-Focus Model of Creative Mastery

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Summary

Both children and adults bring unique resources to creative pursuits. In the design thinking tradition, students are encouraged to blend child-like and adult approaches in creative work. This blend is considered essential for high creative performance. Descriptions of both approaches have been condensed in the Sense-Focus Model of Creative Mastery. This paper explores child-like approaches in a sense-mode and adult approaches in a focus-mode in the realms of motion patterns, selective attention and work place designs.

Keywords: attention, adult, child, creative mastery, design thinking, emotion, motion, sense-focus model

I. INTRODUCTION

Children of kindergarten age have long been recognized as highly creative (Gardner, 1982). They indulge in imaginative play, make spontaneous creations in large numbers, curiously explore novel subjects and learn on the fly. At the same time, it is striking how in "the history of science and technology, all the major steps taken by humanity were made by adults" (Corazza, 2016).[1] Thus, it seems both children and adults bring important and maybe distinctive resources to creative pursuits.

In design thinking education (the professional background of the authors), an intricate combination of child-like and adult approaches

is taught to fuel creative mindsets and facilitate radical innovation. Specifically the child-like approach stands out in the context of university education. Design thinking visionary Hasso Plattner does not report a rare experience as he recalls: "I gave a talk at Potsdam [about design thinking]. Afterwards someone from the audience remarked that everything I had been talking about sounded like what his daughter did in kindergarten" (2009, p. 22, our translation). Next to such a kindergarten- and child-like approach, skilled adult approaches are also considered essential in design thinking. "Being advanced in one's university studies or even having completed one's degree is the best precondition to not only learn about design thinking, but make effective use of it" (Plattner, Meinel & Weinberg, 2009, p. 67, our translation). This ideal of balancing child-like and adult approaches invites an academic commentary: Why in particular are the two approaches essential for creative success? What does each approach contribute?

THE SENSE-FOCUS MODEL OF CREATIVE MASTERY

Studies into the history of design thinking revealed repeated descriptions of 'two roads to creation,' which have been identified by some authors as typical approaches of children versus adults (von Thienen, Clancey, Corazza & Meinel, 2017; von Thienen, Traifeh & Meinel, 2018; von Thienen, Clancey & Meinel, 2019). As a variety of terms have been used to describe the two roads, we rendered core descriptions in a unified framework: the Sense-Focus Model of Creative Mastery (von Thienen et al., 2018).

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[1] Corazza, G. E. (2016, Sept. 2). Personal e-mail correspondence.

When people proceed in a *sense-mode*, they explore new ways of seeing, hearing, feeling and experiencing. They 'let loose,' do what feels right, act spontaneously, humorously and playfully. They use unstructured approaches, follow their intuitions, impulses and curiosities. These are called *means of feeling*. Children are said to typically engage with the world in a sense-mode. This approach is taken to facilitate the discovery of unanticipated possibilities; it is considered specifically helpful to explore and master fields that are novel and unfamiliar. Moreover, the approach is a pre-verbal and pre-cultural mode of learning and exchange. People can make common experiences, even when they speak different languages.

By contrast, proceeding in a *focus-mode* includes rational planning. People build on domain-specific skills as they reflect, analyse and synthesize. They exert meta-cognitive control and meta-rationality. They apply structured approaches. Thus, people are said to use *means of reason*. This approach is acknowledged as yielding highly sophisticated outcomes. It is considered the typical approach of adults. However, learnings are difficult to communicate across domains. Therefore, creative pursuits tend to follow the trajectories of given paradigms with little divergence. E.g., drawing from their professional expertise, a chemist and a musicologist will each be able to make highly nuanced analyses and skilful syntheses in their work domains, but inter-disciplinary exchange is challenging.

THE CREATIVE PROCESS AS A MOTION METHAPHOR

The blending of child-like and adult approaches can be seen, metaphorically, in models of the creative process, which visualize wide explorations of conceptual spaces and eventual convergence. Fig. 1 re-interprets Tim Brennan's process model (cf. Dubberly, 2004, p. 10) as a combination of prototypical motion patterns of children and adults. This interpretive lens seems both likely and promising given that brain and embodiment research indicate a direct connection between motion patterns and creative performance (Leung, Kim, Polman, Ong et al., 2012; von Thienen, 2018). Furthermore, brain structures that mammals use to manoeuvre in physical spaces are re-used by humans to manoeuvre through conceptual spaces (Hartley, Lever, Burgess & Keefe, 2014; Schafer & Schiller, 2018). Thus, exploring motion patterns both literally and metaphorically can shed light on typical resources of children and adults, which need to blend in creative work.

Phenomenologically, adults who want to get from A to some distant point B typically pre-plan their path. Taking the shortest distance on pre-paved roads is time and energy efficient. Maintaining attention closely attuned to goal B helps to ensure that the goal is reached reliably. In case external circumstances require a divergence from the pre-planned path (e.g., because a road is closed due to construction activities), this is typically perceived as a nuisance. In that case, the path is re-calculated, such as to 'overcome the disturbance' as quickly as possible. This corresponds to work in a focus-mode.

Children of kindergarten age usually do not pre-plan longer walking routes. Their attention is easily captured by surrounding experiences as they walk along. A closed road with a huge digger can be exciting and attractive, rather than a nuisance. Anything around can elicit interest – a large stick in the park to the left or a shop with colourful exhibits to the right. Motion paths lead here and there and many unanticipated experiences are made along the way. Yet, there is a considerable chance that this playful exploration will never lead to a distant goal-point B. This corresponds to work in a sense-mode.

Fig. 1 Re-interpreted

High-level creative performance obviously requires a combination of both prototypical motion paths: There needs to be a reliable

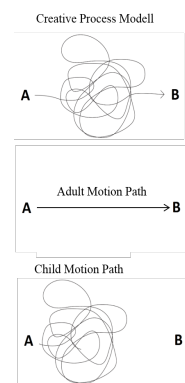orientation towards goal B, to ensure convergence. B should be reached, eventually (adult approach). Still, along the way, there needs to be freedom to enjoy and explore the unanticipated (child-like approach). Otherwise, the process is constrained along pre-established trajectories, such as the 'pre-paved roads' in scientific or technological paradigms. Pre-planned paths render unplanned discoveries or leaps unlikely.

SELECTIVE ATTENTION

Phenomenological observations of motion patterns are highly congruent with research on selective attention and creative performance. People who display highly selective attention (corresponding to adults running straightly from A to B without attending to stimuli around) show reduced creative performance, while people with a large "breadth of attention" or "leaky filters" excel (Kasof, 1997; Zabelina, Saporta & Beeman, 2016). This finding is robust across sensory channels, individuals and groups. For instance, an eye-tracking study finds increased creative performance among individuals who openly attend to seemingly irrelevant, "off-topic" visual information on a screen (Agnoli, Franchin, Rubaltelli & Corazza, 2015). Similar observations are made in groups, who show increased creative performance when the team members pick up seemingly irrelevant, off-topic information in the course of their verbal exchange (Menning, Grasnick, Ewald, Dobrigkei et al., 2018). These findings can be re-read in light of studies that demonstrate less selective attention in children, compared to adults (Plebanek & Sloutsky, 2017).

CREATIVE PLACES

Next to attention-mechanisms, sensual and emotional experiences are also a central subject, where child-like and adult approaches can be compared. As Agnoli and Corazza (2019) highlight, the role of emotions in creative processes is often underestimated. In the Sense-Focus Model, it is specifically the sense-mode, where creative processes are expected to thrive

on diversified emotional experiences – whereas in the focus-mode, seemingly irrelevant/novel information can be at risk of being experienced in a negative way. Correspondingly, at least in the design thinking tradition, architectural layouts for creative projects strongly encourage work in a sense-mode. Indeed, numerous design elements are borrowed from the sensually rich environments of kindergartens, including ample craft materials, Lego boxes etc. By contrast, many offices at universities rather promote work in a focus-mode, as in a room with a single desk next to a large shelf of mathematics books. While a person in this latter environment is encouraged to make creative contributions in her paradigm, she is unlikely to discover alternative (non-mathematical) solution strategies, let alone alternative (non-mathematical) problems worth tackling. An experiment with different learning environments has shown that experientially rich places indeed boost creative mindsets and radical innovation among students, compared to the "deprived" environment of traditional university classrooms (von Thienen, Noweski, Rauth, Meinel et al., 2012). Environments that facilitate child-like approaches of information processing and behaviour have thus been found to enhance creativity even in adults.

II. CONCLUSIONS

Observations in the fields of motion patterns, selective attention and place designs suggest systematic differences in the ways children versus adults engage with the world. Both approaches yield distinctive resources for creative pursuits. While child-like approaches are rarely encouraged in university education, they can be highly serviceable to promote creative leaps instead of mere incremental progress, to facilitate interdisciplinary collaboration and to ease the use of emotions as guides to better creative outcomes.

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Digital Creativity Tools Framework

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Summary

The objective of this study is to define a framework for clustering and analysing digital tools that facilitate the Design Thinking process. The framework, based on an extensive literature review, is developed as part of a more articulated and complex ongoing research aiming at identifying the most crucial factors that influence creativity in the digital era. The purpose of our model is to map and classify digital tools in order to support designers to face the digital transition. This study outlines the way in which we produce new ideas and different forms of knowledge through a creative design process by adopting digital technologies.

Keywords-component: Digital tools, Digital Creativity, Design thinking, Creative Process.

I.   Introduction and Aims

In the last years, the integration of new digital technologies has been used not only to innovate products and services, but also to support and foster the creative design process.

Increasingly, the digital era and its technologies are having a profound influence on the digitally enhanced generation who need to develop new competencies and skills among which human creativity is the most important one. It is, therefore, becoming essential for the design research to understand how digital technologies are influencing the creative process and creativity abilities to develop appropriate tools and models for the next digital generation of designers representing the actors of a near future.

Indeed, designers are facing a digital revolution which required them to be prepared to work in an interactive digital world in which everybody does design (Manzini, 2015) in order to address new technological challenges achieving large-scale innovation.

The digital transition is affecting also the tools that designers adopt to follow the different steps of the design process such as gathering and sorting different information or generating project opportunities and identifying new directions. This study presents a framework that deconstructs the design process into activities and creativity factors, and defines the taxonomy for clustering the tools that could potentially play a role in all stages of the design process.

Starting from our expertise and knowledge about the Design Thinking approach (*Meinel & Leifer, 2015, Canina & Bruno, 2018)*, according to the creativity factors, we analysed for each phase of the design process which digital tools could be applied to facilitate design activities.

All the tools identified during the research could enhance designer and non-designer's creativity in different terms, some of them are more design phase-specific and others are more collaborative or linked with the entire design process.

The framework will deliver a repository of digital tools based on the steps of the design thinking process to empower creativity in different contexts, improving products and services on a holistic level.

II.   DIGITAL CREATIVITY

Creativity has a fundamental role in the design process, is not the domain of a few called

"creatives". Every creator throughout the design process should be guided by creativity in order to enrich his project with new insights and innovation opportunities.

By the coming of digital technologies, designers started to adopt the new potentialities offered by the latter. They recognise certain possibilities allowed by the digital, but also emphasise that there may be certain kinds of limits that get left out when engaging with digital technologies.

This belief was born when platform and digital tools began to appear, which is the same moment the definition of Digital Creativity was coined. Lee and Chen, (2015) describe it as: "All forms of creativity driven by digital technologies. In other words, digital creativity occurs when digital devices are used for various creative activities".

Digital Creativity is the result of a creative process implemented by a computer aided technology. Every time we employ tools or platform for supporting our creative thinking, the digital technology dynamics and mechanics influence creativity principles, that are motivational, cognitive, and attitudinal constituents of the design process. (Corazza & Agnoli, 2015).

III. THE FRAMEWORK

The inquiry that has been conducted, started with an analysis of the basic design tools for Design Thinking. Both for illustrating the state of art of analog tools and to give an exemplification of what kinds of techniques design currently offers. Secondly, we determined to go deeper in terms of specificity and to cluster a series of digital tools who could enhance the creative approach for each phases of the design process. We examined the distributed nature of digital creativity along dimensions such as design phase specificity, collaboration, gamification and level of interaction.

We adopted the IDEActivity process as the specific Design Thinking approach (Canina, Coccioni, Anselmi, 2015). Clarify Goal, Define Opportunities, Ideate and Prototype are the main phases of the process and the four cluster within which we placed all the digital tools.

The first macro area contains the phase-specific digital design tools that are online platforms or tools repository with a high level of specificity, which support one specific phase of the process. Here we can find for example tools characterised by computer-mediated brainstorming, tools that allows to capture plans and ideas in a web-based virtual whiteboard (i.e. Miro), or others only for testing and evaluating already existing prototypes (i.e. Proto.io).

The second macro area contains multi-phase design tools that are all those platforms that could keep track of the entire process. They are totally cloud tools that allow the collaboration between team members to develop new projects, from ideation and envisioning to gathering feedback directly from users (i.e. Shape by IDEO).

The tools grouped in the last cluster, collective creative tools, are mainly used by a design facilitator for training and co-design sessions with a larger audience (i.e Stormz). In this macro area, we can find also a subgroup of tools who enhance real-world interaction, discovery, exploration, and imagination through Augmented or Virtual Reality (Zund et al, 2015).

IV. Conclusions

The research and the development of the taxonomy and the framework wished to identify some of the characteristics of the digital tools that nowadays designers can use in order to expand their minds and visions. As Literat and Glaveanu (2018) affirm, this new typology of tools emphasises individuals and individual minds. In fact, it is exactly the emergence and growth of digital technologies that contributed to new, systemic ways of thinking and talking about creativity.

The developed taxonomy highlights tools intended for a wide variety of uses and varying in complexity, from a simple tool with one specific function to multiple function tools or an entire suite of tools. The framework allowed us to characterise every tool with its own phase of intervention in the design process, and to identify areas in which nowadays there is an absence of supporting tools. We can, therefore, assume that the generated framework will benefit several contexts and open opportunities for other future researches. For example, it could

support companies aiming to adopt digital creativity tools for exploring and anticipate design opportunities and needs. In the design field, it could shape new digital creativity tools to support designers at all stages of the design process and to diverge their thinking and get carried by lateral thinking.

This research is at an early stage and doesn't have the ambition to map all the existing digital tools that can support the creative design process. The speeds with which these tools and digital technologies are emerging and developing would make the research never complete. The main aim is to identify in the different steps of the process the relation between the tools, the activities and the creative factors of the step itself, to facilitate the achievement of a more novel and useful result. Future directions aim at testing some of those tools in a real design setting, in combination or in comparison with other analog tools, to verify and understand what features can better meet the designers of the digital era works.

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Keynote Speech

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Exploring Creativity's Positive Outcomes

As a field, we often focus on what variables help improve creativity. When we do talk about creativity as a predictor variable, we often focus on the negative (such as mental illness or malevolence). When we do focus on positive outcomes, we often limit ourselves to school and work success – even though other attributes are better predictors. I will highlight a myriad of other positive outcomes of creativity, with a particular focus on issues of social justice and meaning.

SESSION 4

Microserendipity in the Creative Process

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Keywords: Serendipity, Creativity, Distributed Cognition, Problem Solving

I. INTRODUCTION

Creativity has been described as 'stronghold for individual based psychological theories' (Glăveanu, 2015, p.1) but despite a dominant thread that views creativity as a personal process distinct from social recognition (Runco, 2019), creativity is increasingly being seen as arising, not from linear planning but from a dynamic interplay between the person and the environment (material or social) in which he or she is situated. It is our argument, that this view of creativity as distributed requires a parallel reconsideration of creative agency. Agency (distinct from the sense of agency [Malafouris, 2013]), no longer rests solely with the creator but is instead extended across a creative system. A space opens up, therefore, for unplanned and unexpected events arising from random environmental chance to feed into this system. We argue it becomes more appropriate to characterize the elements of the creative process as actants (Chappell, 2018) with equal influence on the overall emergent agency of the creative entity. This emergent coagency is better known as serendipity – the fortuitous combination of chance and wisdom.

SERENDIPITY

Serendipity refers to a happy mixture of environmental chance and individual sagacity; both aspects are necessary for an event to be serendipitous. It is this bipartite nature that differentiates it from luck and mere accidents (Foster & Ellis, 2014). To 'equate serendipity to chance is to unravel but part of a far more promising plot' (de Rond, 2014, p. 342). The environment affords many opportunities for luck, but these are useless without the right person (or organisation) at the right time to capitalise on those moments (Cunha, Rego, Clegg, & Lindsay, 2015). At this moment of recognition, when the environment becomes part of the cognitive ecosystem, inert luck becomes serendipity. A person on his or her own cannot be serendipitous any more than an environment can. Serendipity by definition is a relational phenomenon (Björneborn, 2017) contingent on the interaction between environment and the person and thus, requires a truly systemic way of regarding human behavior.

Although luck is often mentioned in anecdotal reports of creativity (Csikszentmihalyi, 2013; Sawyer, 2018), there has yet to be a serious consideration of the role of serendipity in creativity beyond the anecdotal and, further, how the interaction between the person and the material world generates it. Indeed, we are only aware of one paper which considers serendipity in insight problem solving (Steffensen, Vallee-Tourangeau, & Vallee-Tourangeau, 2016). This is perhaps because psychology displays a 'lack of attention to the factors which escape prediction and control' (Cunha, Clegg, & Mendonça, 2010, p. 321) however salient those factors may be.

MICROSERENDIPITY

In classic descriptions, serendipity only happens when it is recognised as such by the people making the discovery. In these self-reports if there is no awareness, then an event will clearly not be categorised as serendipitous. So, not only is serendipity temporally dependent and it is also meta-cognitive and, as

such, a subjective and unstable phenomenon. It is typically identified in hindsight, as the end point of a process which relies on the person's judgement at that point in time. With this understanding, it is impossible to announce in advance that there is going to be a serendipitous moment; by its very nature serendipity is unplanned and unexpected (Copeland, 2017).

While the empirical study of the importance of serendipity in this personal and restrospective manner is gaining momentum as a research field, it has not been studied in a systematic way in the cognitive psychologist's lab. However, if we understand cognition as an ecosystem arising from an active engagement between people and things, we also need to examine the moments when the environmental agency precedes the agency of the person to create an emergent coagency; in other words, serendipity.

This requires a new methodology for both research into serendipity research and creative cognition. We need to be more suspicious of the use of aggregated and smoothed means as behavioural measures of performance. Equally, the subjective sense of serendipity should be disentangled from its actual occurance. We would name these moments microserendipity, that is the moment in a cognitive arc in which both the environment and the person combine to progress the creative product. These moments may ultimately be either pivotal or trivial in the overall creative project but the micro level will still be similar in nature. Isolating these moments allows us to more accurately reflect the contingent, relational and emergent nature of the creative trajectory.

II. CONCLUSIONS

Methodology is not neutral to our understanding of the ontologies of both creativity and serendipity. Current research on creative cognition presents results as aggregated means whereas qualitative research points to a unique and contingent creative trajectory whether in insight problems solving (Steffensen, Vallée-Tourangeau and Vallée-Tourangeau,

2016) or artistic creativity (March, 2017). It is our contention that isolating moments of microserendipity will structure some aspects of this singular and contingent arc.

If we are to study the whole cognitive ecosystem, then coding and recognising moments of externally generated microserendipity regardless of people's post task recognition of that moment will deliver a more granular and detailed account of the role of luck in the creation cognition.

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Session 4

How can the observation of the dynamic process of pupils help them in their process?

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Summary

Beghetto and Corazza (2019) proposed to study creativity through a dynamic perspective. But how can one observe and teach a dynamic creative process to pupils? In this paper, we propose to start by observing the creative process of pupils directly during their class to understand what they really do and, then, to use these observations to try to adapt the teaching to pupils.

Keywords-component: Creative process Report Diary (CRD), Pupils, Images, Multivariate factors, Project pedagogy.

I. Introduction

Since more than twenty years, researchers on creativity have defined it as the ability to produce new and adapted ideas (Lubart, et al., 2015; Runco & Jaeger, 2012). But recently, Corazza (2016) proposed to add the term "potential" in the definition: "creativity requires potential originality and effectiveness" (p.262) indicating that it is a dynamic concept. A production can be not creative at time but be creative after.

The book "dynamic perspectives on creativity" offers a new way to study creativity (Beghetto & Corazza, 2019), as the creative process. In what is it dynamic? Botella and Lubart (2019) defined its dynamism "by its components itself, their organization, their combination, the successive interactions it

maintains with the environment, the unfolding nature of a phenomenon over time and its cyclical nature." (p. 272).

But researchers on creativity have still to face two difficulties: (a) how to observe it; and (b) how these observations could help pupils during their process? The aim of the present paper is to propose a tool to observe the dynamic creative process in pupils' class and to discuss the impact of such tool on learners. For that purpose, we will take an example with pupils realizing a project consisting of invention of character from space with modeling clay.

The Creative process Report Diary for pupils

Botella et al. (2017) proposed a tool to observe the dynamics of the creative process: the Creative process Report Diary (CRD). A CRD can be entirely adapted to the population studied and to the questions of interests of the researchers. Generally, a CRD includes two parts: one on the stages of the creative process; one on the factors involved in this process.

But a CRD was mostly conceived for adults. How to adapt it to pupils? Based on previous published and unpublished studies using CRD in various populations as artists, engineers, students, teachers, etc. (Botella et al., 2017; Glăveanu et al., 2013), we will start in this paper by presenting an adaptation of a CRD for pupils. For that purpose, instead of text describing each of the twenty stages retained or twenty factors, we built images with a

professional designer familiar with creative process (see Figure 1).

Figure 1. Example of image adpated for pupils in the CRD

OBSERVATIONS: THE SPACE PROJECT

Then, the objective of this paper is to focus on understanding the creative process of pupils in solving a complex task (artifact design and production) using a CRD. The use of the CRD allows pupils to identify key aspects related to their creative process, approaching the aspects of one's creative process related to *cognitive* factors (analyzing, evaluating and solving a problem situation by seeking innovative and adapted solutions), *conative* factors (perseverance, structuring, patient, risk taking, commitment to the task, autonomy, intuition), *emotional* factors (positive and negative feelings in the face of the complex task) and *environmental* factors (collective work, mutual aid, individual work) (Lubart et al., 2015).

So, we used the new CRD pictured and adapted for children with a class of 16 pupils (10 girls, 6 boys; aged from 10 to 11 years old). During their Creative and Manual Activities, pupils had 5 lessons to build a character from space with modeling clay and to write him/her/it story with an initial situation, a surprising event and a changed situation. At each lesson, pupils have to check the stage(s) and factor(s) they used during the lesson.

Among the twenty stages presented in the CRD, results indicated that many pupils checked stages of documentation (81%), constraints (81%), insight (81%), inspiration (69%) experimentation (63%) and definition of the problem (56%) during the first lesson whereas at the last lesson, pupils reported more associative thinking (88%), insight (81%), realization (81%) questioning about the project

(69%), verification of their ideas (63%), and judgement (56%). Examining especially the transitions between the stages, results indicated that the most frequents transitions were from definition, questioning, and documentation to realization, and from inspiration to benefiting from chance. Finally, with a correspondence analysis crossing stages and factors, we examined which multivariate factors are the most important for each stage Results indicated a high involvement of fear, doubts and surprise in the selection stage, and intuition and perseverance in the definition stage.

Such results showed that creative process is dynamic: pupils did not engage the same stages at each lesson, many ways and transitions between the stages are possible, and each stage is associated with specific multivariate factors. It is obvious and very important to allow teachers to understand the implications of such dynamics.

TEACHING OF THE CREATIVE PROCESS

The CRD brings about a change in the understanding of the pupil's creative process but also in their identification and awareness of the learning strategies mobilized (research and evaluation of solutions to complex tasks). The CRD introduces changes in teachers' practices because it contributes to the institutionalization of a moment of reflection dedicated to understanding and developing an education of creative potential (Runco, 2003).

Based on these observations, we will now propose some ways of how to help pupils in their creative process. The first aspect concerns the development of pupils' creative process supported by professional gestures of expert teachers. In fact, we observed that the expert teachers introduce references (photos, books...) to encourage the search for creative ideas in lesson 1 and, in lesson 5, the children evaluated their creative ideas in relation to their own production. The evaluation of ideas is carried out individually and collectively. Indeed, the expert teachers use the collective explanation of knowledge which makes it possible to move from "doing" to raising awareness of the different knowledge mobilized by students.

This contributes to learning for students. We observe also that the multivariate profile of the stages indicates that the selection is associated with fear and that children feel doubts and surprise. In this study, we noted the need to introduce a real change in teaching practices that does not sufficiently take into account the relationship between emotions and learning. Many studies had already examined the role of emotions on creativity (see Davis, 2009 for a meta-analysis) and the climate is also important to not induce emotions inhibiting the learning (Govaerts & Grégoire, 2014). This research therefore could participate to modify the representation of this articulation between emotion and learning.

The observation of the dynamic creative process of pupils seems to offer new perspectives for teaching because it: encourages risk-taking, allows for errors, fosters the imagination from a variety of perspectives, and promotes the formulation of hypotheses. In fact, the use of CRD introduced with a teaching for creativity (Lucas, 2001) improves creativity-supportive practices in the classroom, which includes: 1) explicitly teaching for creative thinking, 2) providing opportunities for choice and discovery, 3) establishing a creativity-supportive learning environment, and 4) providing opportunities for students to use their imagination while learning (Beghetto & Kaufman, 2014). Understanding the creative process of learners based on the CRD helps - to foster creativity in school and to develop other cross-cutting abilities, such as the reflective approach, creative thinking, problem solving, cooperation, learning strategies, anticipation, and decision making (Miller & Dumford, 2014).

II. Discussion

As every study realized in real learning context, some questions appear. In first, we can ask if the presentation of the check-boxes stages in the CRD alters their initial, intuitive approach to the creativity challenge. Because it is already difficult for adults to verbalize the stages/factors of their creative process (Glăveanu et al., 2013), we decide to make an inventory of all previous studies indeed to have a complete panel of stages and factors. But it is still a limitation. In second, interview of pupils would help to make this inventory. It could be a path for futures researches. However, it is important to notice that pupils are in class, doing their own production for their Creative and Manual Activities. The goal of the CRD is to preserve an ecological validity, minimising the importance of the researcher in the learning context.

The present paper is a preliminary work on how to improve the teaching based on observations of the creative process of pupils. It will be then important to test the effect of the CRD on the creative process and the teaching, and also to take into account the individual differences between teachers and their approach.

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Runco, M. A, (2003). Education for Creative Potential. Scandinavian Journal of Educational Research, 47(3), 317- 324to mathematical ability.

Polyphony and Creative processes in the Classroom and in Higher education

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Summary

The focus of this paper is polyphony and creative knowledge processes and how teachers can enable for such processes in the classroom and in higher education. The paper is based on qualitative research on how creative knowledge processes were led in interdisciplinary working groups and I will describe how these findings were transferred to a different context: teaching in higher education and forming a didactical model for leading such processes in interdisciplinary student groups. I believe this model with an emphasis on how to stimulate creativity, is relevant in all classrooms at different levels in the education system. First, I present the concept on 21 Century skills. Further, I describe shortly the case on creative knowledge processes in the working groups before I describe how the findings were transferred to the educational context and formed a didactical model. Finally, I discuss this model in the light of dialogical pedagogy.

Keywords-component: dialogic pedagogy, creativity, knowledge, 21st Century Skills, education, polyfhony

I. Introduction and Aims

One of the schools most important tasks is to prepare children and youth for a future we do not know. The concept of "21st Century Skills" is about different skills that are pointed to as important for coping in the future. In Norway there is also a new curriculum under development and this gives guidance for teachers both in what to teach but also how to teach their students. In both 21. Century skills and the new curriculum there is an increased focus on creativity and interdisciplinary understanding and collaboration.

In this paper I aim to explore polyphony and creative processes in the classroom. I will present and reflect on a didactical model describing Knowledge development in interdisciplinary groups of students in higher education. The model (STEPRE) consists of different steps/phases and is based on research conducted on interdisciplinary group members in knowledge intensive organizations (Ness, 2017; Ness & Riese, 2015; Ness & Søreide, 2014).

Case study

A case study on interdisciplinary group members in organizations had a focus on creativity and how innovative ideas were developed. The design was a qualitative field study and I collected data in three different groups in knowledge intensive organizations. First, I conducted participating observations over a period of 18 months. Then I conducted focus group interviews with all the groups, and finally I conducted semi-structured interviews with the group leaders as well as 5 other innovation leaders. I audio recorded everything, and video recorded some of the meetings and ended up with a large amount of data to analyze. The analyses of the data were inductive, and I was reading through the transcripts and extracted meaning into categories. The coding was done in Excel.

The study was data driven but still informed by sociocultural psychological theory. This means

that this theoretical lens guided my interpretation of the data but also what I looked for. In sociocultural theory we are interested in relations and believe that knowledge and ideas are constructed between individuals and not just within individuals. Thus, I was interested in how the group members communicated and interacted and what patterns could be identified when I investigated what characterized the creative processes.

The findings showed that developing innovative ideas was, to a large extent, about bringing together different perspectives and letting group members dialogue with each other and co-construct ideas (Ness, 2017). However, gathering group members from different expert fields did not guarantee knowledge development – the group members needed some relational skills in addition to their expertise and I discovered openness, curiosity and respect to be important qualities in interdisciplinary groups (Ness & Riese, 2015). After all, they had challenges understanding each other's terminology and mindset and this often hindered the interdisciplinary collaboration.

An example on how relational skills were visible was when Eric said this in an interview when we talked about challenges and advantages involved in such interdisciplinary group work.

Eric: *"We have different competences gathered in one place so to say, and there is a huge potential in tossing things back and forth between the different people. This synergy is really good, that we can say what is on our mind — and if someone disagrees, that is ok too. There must be trust in the group so that everybody participates. And also respect and understanding for each other's special competence is important, I think. Why do we say the things we say".*

Another example on the importance of relational skills is how Eric seemed interested and curios towards Miriam, one of the other group members. Eric: *"I am really curious, I am.. because when you said this, Miriam, I get "goosebumps" – it is so exciting to me, I am eager, you have all this "prima" knowledge on this so can you tell me how the (...) can be attached to (...)?*
[He laughs and gives Miriam a big smile]

In addition I found that the leaders needed to facilitate by encouraging active participation and discussions of different perspectives (Ness, 2017). The process went through phases and the group members´ level of activity was different at different times of the process (Ness & Søreide, 2014).

Based on this study, I transferred the findings to a similar context: interdisciplinary student groups in higher education working together at seminars at a Norwegian University. In a learning and knowledge developing context both group members in organizations and students at seminars seemed to co-construct new ideas in similar ways. Both in the working groups and in the student groups the aim was to learn together and to develop new knowledge and perspectives. The name, STEPRE, is due to the way the model shows different steps and is based on abbreviations of the names of the identified phases: *Start, Theory, Examples, Polyphony, Reflection,* and *Evaluating*.

First, I will present the concept on 21st Century skills. Further, I describe shortly the case on creative knowledge processes in the working groups before I describe how the findings were transferred to the new context and formed a didactical model. Finally, I discuss this model in the light of dialogical pedagogy.

21st Century Skills

The world is facing unprecedented challenges – social, economic and environmental – driven by accelerating globalization and a faster rate of technological developments. The children entering education in 2018 will be young adults in 2030. Schools can prepare them for jobs that have not yet been created, for technologies that have not yet been invented, to solve problems that have not yet been anticipated.

To navigate through such uncertainty, students will need to develop curiosity, imagination, and they will need to respect and appreciate the ideas, perspectives and values of others.

Education can equip learners with agency and a sense of purpose, and the competencies they need, to shape their own lives and contribute to the lives of others. To find out how best to do so, the Organisation for Economic Co-operation and Development (OECD) has launched *The Future of Education and Skills 2030 project* (OECD, 2018).

THE STEPRE MODEL

The purpose behind the STEPRE model is to offer a didactical tool to the teacher in order to stimulate creativity and collaboration in the classroom.

The STEPRE-model is a way to structure teaching with a starting phase to prepare the students for the main learning activity in the middle phases, and then after this activity, sum up and evaluate in the last phases. The model also shows how the student activity had different levels throughout the phases with the colors red and yellow indicating most student activity.
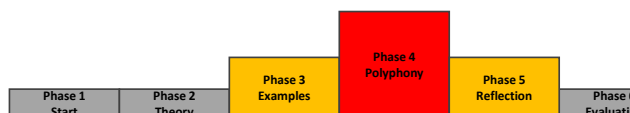
DISCUSSION

Both in the large ethnographic study and in the student groups, imagination was stimulated

by the tension between the diverse perspectives in the groups as well as the dynamics between the group members and students.

According to a sociocultural perspective and Bakhtin (1984, pp. 87-88), ideas are born in dialogic polyphony and will continue to develop when they meet other ideas, since the idea does not live in one person´s isolated mind, but takes form in the meeting with other ideas. The point is that ideas are developed between people and not just within the individual person.

Bakhtin's concept of dialogic polyphony highlights how knowledge and ideas are created in the tension between different voices (Morson & Emerson, 1990) acknowledging each other. In order for new knowledge to emerge there must be a dialogue between several perspectives or voices, and it is particularly productive if these voices are in opposition to each other (Igland & Dysthe, 2001; Morson & Emerson, 1990). In other words, meaning and knowledge were created through the interaction between the students, and the tension between different voices acknowledging each other (Linell, 2009). Previous research also shows that discovering how knowledge and assets can be redefined and connected in novel ways requires heterogeneous networks of people. Such networks can expose people to a diversity that can inspire and enable creativity and knowledge development (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Woodman, Sawyer, & Griffin, 1993) as it can create fruitful tension between positions and perspectives.

II. CONCLUSIONS

Both in the working groups and in the student groups the aim was to learn together and develop knowledge. This required active participation. The STEPRE model can help the teacher to structure her teaching in order to stimulate creativity and collaboration in the classroom. This happens through different activities and with open questions, different interpretations and not just «yes/no questions». This way of teaching is in line with dialogical

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pedagogy and Bakhtin´s polyphony concept where new knowledge and ideas are created in the tension between different voices (Morson & Emerson, 1990) which acknowledge each other.

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SESSION 5

Creativity:
Towards a situated-embodied cognition perspective

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Summary

The present study investigates the situatedness of creativity by comparing verbal responses on a creativity task of children in a low-stimulus environment with children in a stimulus-rich environment. With use of eye tracking, eye movements of children are also analyzed to derive the extent to which children make use of their surroundings when they are producing unexpected uses of objects and to gain insight in the process of perceiving affordances. Results will be presented and discussed.

Keywords-component: creativity, embodied cognition, eye tracking

I. INTRODUCTION

Although researchers acknowledge the importance of investigating how people come up with creative ideas, only a few studies have focused on the impact of the environment on creativity. The majority of previous research has examined creativity within a psychological trait framework. Such a perspective does not take into account that cognitive processes are regarded to be situated-embodied, meaning that they are influenced by environmental factors, and by a person's perceptions of and actions towards these environmental factors (Barsalou, 2008). From a situated-embodied cognition perspective, creativity can be defined as the emerging skill of an individual to discover more complex affordances, in which several action possibilities are combined. This could lead to discovering and applying novel uses of objects, ideas, and solutions. Creativity requires extensive exploration of possible affordances.

By investigating the situatedness of creativity, we aim at gaining insight in both the creative product (creative outcomes) and the creative process (perceiving affordances and combining them towards a creative idea or product).

II. CREATIVITY AND SURROUNDINGS

In accordance with the embodied cognition perspective, we propose that creativity measures seem to be dependent on task and situation characteristics. Based on experimental data, Kharkhurin and Altaribba concluded that testing Arabic-English bilingual participants in English context leads to different creative behavior than testing them in an Arabic context. This observation shows that creativity can be different across situations due to manipulated factors. In line with these

results, differences in physical surroundings could also lead to differences in creative outcomes. Creativity requires extensive exploration of possible affordances (Glăveanu, 2016). Exploration is needed to uncover new action possibilities, and intermediate outcomes need to be evaluated. In this view, observed creativity depends on multiple action affordances present in the situation. A stimulus-rich environment would

offer more relevant properties than a low-stimulus environment, which may increase the possibility of discovering novel uses of objects, ideas, and solutions. For the purpose of the present study, we compared the creative outcomes of children in low-stimulus environment and a stimulus-rich environments.

III. CREATIVITY AND EYE TRACKING

In creativity tasks, measuring a participants eye movements can provide insight into the creative process, because it reveals to which elements the participant attends in solving the task (Andrá et al., 2015). By analyzing eye tracking data, it is thus possible to investigate the extent to which children make use of their surroundings when they are generating unexpected uses of objects. Gaze patterns can moreover reveal specific gaze patterns. Previous research of Schindler, Lilienthal, Chadalavada, and Ögren (2017) on mathematical creativity has shown its usefulness in this respect, by demonstrating that eye tracking data sheds light on how creative ideas evolve and how students inferred them.

IV. HYPOTHESES

In our study, it is hypothesized that physical surroundings play an important role in facilitating creativity. With regard to the creative output (verbal responses), we expect that the children in stimulus-rich environment outperform children in the low-stimulus environment. Different in both the amount of unusual uses and in originality are expected. Regarding the process, it is expected that children who make more use of their surroundings (look more at the objects) are found to be more creative than children who make less use of their surroundings.

V. METHODOLOGY

75 children (age range: 10-12 years old) participated in our study. Firstly, an adaptation of the visual Alternative Uses Task (Agnoli, Franchin, Rubaltelli, & Corraza, 2015) was used. Children were asked to produce possible new, crazy or unexpected uses of a target object. Five trials of five minutes were administered. Eye movements (i.e., fixations) were recorded by the Tobii Pro Glasses. The recording started at the beginning of the first trial, and ended when participants finished the fifth trial. Children were randomly assigned to two conditions. In the first condition, the target object was the only object on the table. In the second condition, the target object was surrounded by six other objects. The participants could look at the target object (and surrounding objects) during each trial. Verbal responses were coded on fluency and originality. The eye tracking data was coded with use of Gazecode (Benjamins, Hessels, & Hooge, 2018) to determine which object(s) the children look at. After finishing the Alternative Uses Task, children completed four questions on their strategy use. For example, they were asked how they decided that a use was new, crazy, or unexpected. *Secondly, to control for influences of executive functioning, children performed the subtest Sky Search of the Test of Everyday Attention for Children (TEA-Ch; Manly et al., 1999). Children and their teachers also filled out the subscales Selective attention, Inhibitory control, and Perceptual sensitivity of the Early Adolescent Temperament Questionnaire (Capaldi & Rothbart, 1992).*

VI. RESULTS & CONCLUSIONS

Data collection is currently in progress. At the conference, we present the preliminary results.

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The effect of idea generation tasks on idea evaluation: A large-scale experimental study

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Summary

Keywords: idea generation, idea evaluation, manager, creator, experts, experiment

I. INTRODUCTION AND AIMS

Innovation in the workplace has become an increasingly important determinant of organizational success and long-term survival (Anderson et al., 2014). According to Anderson et al. (2014), innovation refers to implementing – creative – ideas. Ideas require both potential originality and effectiveness to be considered as a creative idea (Corazza, 2016). Thus, before they can be implemented, ideas need to be evaluated on these standards. However, evaluating original ideas for implementation may be difficult as these ideas are by definition different from already existing ideas and their potential successfulness is still unknown (Csikszentmihalyi, 1999). Sometimes, the originality of an idea is related to the abandonment or dismantling of previous paradigms. Every day, workers in all types of companies have to decide which new and potentially creative ideas should be implemented or rejected. This is a difficult job given the fact that managers often have falsely rejected creative ideas in the past that others subsequently developed into highly successful innovations afterwards (see for examples Mainemelis, 2010). To avoid such costly mistakes, more information is needed about how managers can be the most successful in idea evaluation.

Idea evaluation is in itself an under-researched topic (Berg, 2016). Berg (2016) compared circus managers' idea evaluation accuracy in rating videos of circus acts with evaluation accuracy of circus workers who were also involved with the generation of hundred videos of circus acts (i.e. creator role). He found that the managers, who were only involved in idea evaluation, were less successful in detecting novel ideas than the circus workers, who were involved in both idea generation and evaluation. However, Berg (2016) only compared participants who were involved in both idea generation and evaluation with participants who only evaluated ideas (and not generated ideas). As such, his experiment could not disentangle whether one necessarily has to be involved in generating ideas for the specific task in order to enhance idea evaluation accuracy, or whether experience in the generation of creative ideas as such (i.e., in other, irrelevant tasks) is enough for becoming better at idea evaluation.

II. RESEARCH QUESTIONS

The present research investigates how idea evaluation changes depending on the involvement in various idea generation tasks. We specifically compare the evaluations made by participants engaged in the task for which they also created ideas (i.e. creator role) with those of participants who are engaged in idea generation for other tasks (i.e. creator other task or only manager role). We aim to answer the following research questions:

1. What is the effect of involvement in various types of idea generation tasks on idea evaluation?

2. To what extent does this differ between students and experts?

III. METHOD AND PROCEDURE

This study uses a cross-sectional sample of 3,817 German students from the student study "Fachkraft 2020" (Bergerhoff et al. 2017). In this study, university students from all fields of study and all four years of university education filled out an online questionnaire that took about one hour to complete. In total, six idea generation tasks were conducted (two Alternate Uses Tasks and four real-world problems). We randomized these six tasks among the questionnaires. Thus, each questionnaire had two randomly selected idea generation tasks. In this randomization, participants were assigned to one of three conditions: *creator same task-manager* (N = 2,307), *creator other task-manager* (N = 1,116), and *manager only* (N = 394). In the *same task creator-manager* condition, participants generated and evaluated ideas (provided by others) for the same real-world problem task. In the *creator other task-manager* condition, participants generated ideas for another real-world problem task and afterwards evaluated ideas for the idea evaluation task. In the *manager only* condition, participants did not generate ideas for a real-world problem, but only for the Alternate Uses Task (AUT; Guilford, 1967). Afterwards, they were put in the manager's role and evaluated ideas for the idea evaluation task. We performed one-way ANOVA to compare idea evaluation differences between the three conditions. Independent t-test were conducted to compare each condition to the experts' idea evaluation (average of ten creativity experts).

IV. MEASURE: IDEA EVALUATION

The ideas in the idea evaluation tasks had been rated earlier on their originality, feasibility and creativity by creativity experts on a scale ranging from 1 (not at all original/feasible/creative) to 5 (very original /feasible /creative) (see de Buisonjé et al., 2017 for an extensive explanation of this evaluation process). After their evaluation, 39 ideas were selected which showed high inter-rater reliability. Of these 39 ideas, four ideas were evaluated by each student (randomly selected ideas). Students evaluated each idea on their originality, feasibility and creativity (Dean et al., 2006).

V. RESULTS

For the originality evaluation, there was a marginal statistically significant difference between the three groups as determined by one-way ANOVA ($F(2,3740) = 2.95$, p<.10). The participants in the c*reator same task-manager* condition (*M*=3.02, SD=0.72) evaluated ideas as being less original compared to participants in the *creator other task-manager* condition (*M*=3.06, SD=0.69) and participants in the condition *manager-only* (*M*=3.10, SD=0.67). Thus, participants involved in generating ideas for the same task as the idea evaluation topic perceived ideas as being less original as compared to participants who are involved in generating ideas for another task (another real-world problem or AUT). Furthermore, we also find a significant difference between the originality evaluation of experts and participants in all conditions: experts perceived ideas as being less original than participants in the experimental conditions. For the feasibility evaluation, there was no statistically significant difference between groups as determined by one-way ANOVA ($F(2,3742) = 0.82$, p>=.10). In comparison to experts, *creator for another task-manager* condition (*M*=3.34, SD=0.02) evaluate ideas as being less feasible than experts did (*M*=3.39, SD=0.01), $t(1093)=-2.28$, p = 0.023. Also for the creativity evaluation, there was no statistically significant difference between groups as determined by one-way ANOVA ($F(2,3723) = 1.24$, p>.10). Moreover, experts perceived ideas as being less creative than participants who are involved in the generation of ideas for the problem at hand, or involved in another idea generation task.

VI. CONCLUSION

The present study examined the effect of involvement in idea generation tasks on idea evaluation in a large-scale experiment. The

results suggest that people involved in the idea generation task - similar to the one for which they have to evaluate ideas - evaluated ideas as less original than people involved in other idea generation task, such as real-world problem tasks or AUT. Thus, people not involved in the same idea generation task as for the idea evaluation could easily overestimate ideas on their originality. To prevent this overestimation in companies, we recommend managers to be more involved in the generation of ideas for the task. Furthermore, the results suggest that creativity experts consistently perceive ideas as less original and less creative than participants in any of the conditions do. This may indicate that creativity experts have a higher threshold to evaluate ideas as original or creative. Therefore, research should not have a blind eye for experts, but use multiple groups of experts or non-experts to compare idea evaluations.

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Looking in the eyes of the Muses: Eyetracking evidences on irrelevance processing

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I. INTRODUCTION

The study of the role of attention in the creative thinking process has provided a number of insights on the processing and on the use of internal and external information (e.g. Zebelina et al., 2016). Different research lines explored the attentional abilities and mechanisms in creative people and during creative tasks, with a special emphasis on creative ideation through the use of divergent thinking tasks. A first result emerging from creativity research is that the breadth of attention is a main correlate of creativity, showing that individuals with a wider breadth of attention focus on a larger range of stimuli and allow inputs from apparently irrelevant stimuli. According to this results, in these individuals attentive filters are not selective enough to prevent the inclusion of unwanted information into the current processing (Necka, 1999). Consistent findings have been reached by the study of the influence of latent inhibition on creative behavior (Carson, Peterson, & Higgins, 2003), which emerged to be also associated with high levels of creative achievement, creative personality, and the originality index in divergent thinking tasks. Moreover, latent inhibition has been associated with higher levels of Openness (Peterson et al., 2002), which suggests that individuals with higher openness are characterized by a higher access to complexity, which means a wider span of information. A further research line has provided evidences on the fact that higher creative performance is related to effectively focus and switch attention. Findings from this research line revealed the importance of internally versus externally directed attention during creative ideation, highlighting that creative ideation relies on imagination and requires to direct attention to self-generated thought processes (Benedek & Fink, 2019). Research indeed revealed greater internal attention demands during creative thought inducing higher EEG alpha activity (Benedek et al. 2016) and eye behavior indicative of visual disengagement (Walcher et al., 2017).

PROCESSING IRRELEVANT INFORMATION DURING THE CREATIVE THINKING PROCESS

The previous brief literature review showed the complexity of the role of attention during creative ideation. Different and apparently contrasting results seem indeed to emerge from literature, showing the importance of both focused and unfocused attention on creative ideation. Aim of the present talk is to highlight the importance of considering creative ideation as a part of a dynamic thinking process. During this process, attention may not have a main and unitary function, but its function may vary according to the temporal course of the process as well as of the individual differences in the control and use of attention.

While psychological literature has shown the importance of internally focalized attentional mechanisms sustaining imagination during creative ideation, in the present talk the importance of a wider breath of attention during the recruiting of information preceding creative ideation will be shown. This attentional mechanism, which processes apparently irrelevant information, has been recently identified as irrelevance processing (Agnoli, Franchin et al., 2015) and proposed as one of the mechanisms that relates personality with creative performance and creative achievement. Through a series of experimental studies the present talk will provide evidences on the role of irrelevance processing on creative performance and creative achievement. Through the use of

eyetracking data this attentional mechanism will be explained, showing the role and the impact of various attentional processes occurring not during but before creative ideation. The relationship between irrelevance processing and personality will be explored from different perspectives to understand its role on creative performance, confirming its presence over different cognitive domains, and during human development.

II. METHOD AND MAIN RESULTS

In a series of studies creative performance was measured using a visual version of the Unusual Uses Test (UUT; Guilford, 1967), a classical divergent task asking participants to produce unusual alternative uses for common objects, with settings that contain both relevant (the object for which participants were asked to produce unusual uses) and irrelevant information (random objects apparently unrelated to the task; Agnoli et al., 2015, 2019). Using eye movement tracking, the processing of relevant and irrelevant information before the ideation process (i.e., before the ideation of alternative unusual uses) by participants was measured. The impact of the processing of relevant and irrelevant information on the originality and fluency indexes of the divergent task as well as of creative achievement measures was analyzed. A series of studies explored: a) the relation between the openness personality trait and irrelevance processing and its influence on creative performance and achievement; b) the effect of the nature of the stimuli (pictorial or verbal) on creative performance and achievement; c) the interactive dynamics between affective arousal and attentive processing in the emergence of creative performance during affectively laden situations emerging throughout the creative process; d) the developmental trajectory of irrelevance processing and its relation with personality from primary school to adulthood. In all studies the relationship between irrelevance processing and personality was explored, in order to understand the impact of individual differences in this attentional process over creative ideation and creative achievement.

First of all, irrelevance processing emerged as a moderator between openness and both creative performance (originality scoring in the UUT test) and creative achievement (as measured by the CAQ, Carson et al., 2005), with creativity reaching higher levels in individuals who gave attention to irrelevant information and were characterized by a high level of openness. This result poses irrelevance processing as the attentional mechanism relating openness to creativity. Similar results emerged through the use of both a visual and a verbal version of the task. During affectively laden situation inducing either a condition of creative success or a condition of creative frustration, a different personality trait emerged to be associated with irrelevance processing: trait emotional intelligence (trait EI). In particular, in affectively charged situations high-trait EI participants showed a positive association between irrelevance processing and creative performance, exploiting the beneficial effect of irrelevance information on creative performance. Finally, irrelevance processing emerged to be related to creative performance from primary school, passing through lower secondary and upper secondary school, to adulthood. However, a different relationship between irrelevance processing and various personality traits emerged during development, suggesting a maturative pattern in the relationship between irrelevance processing and creative thinking.

III. CONCLUSIONS

In the present talk an overview on the relationship between the processing of information not apparently related to the ongoing task and creative thinking will be provided. The central role of personality in the management of this attentional resource over creative performance will be highlighted. Attentional attitudes expressed though personality traits will emerge as main determinants of creative ideation and creative success, suggesting that the lenses we use to observe the world could have a deep impact on

the creative thinking process. A question dates back in ancient times: can listening to the apparently irrelevant words whispered by the Muses lead us to creativity?

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Session 5

SESSION 6

The process of creativity in the context of social vulnerability, under the understanding of cultural psychology

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Summary

Keywords-component:

Creativity, Social Vulnerability, Cultural Psychology, Resilience, 5A"s

I. INTRODUCTION AND AIMS

Creativity is a current topic, it is discussed and investigated in different social contexts through various theoretical approaches. The excitement in researching such topic is related to its power to help people in adversities, besides allowing the establishment of a more inclusive society.

Throughout this summary a discussion takes place, providing a theoretical analysis of some variants, consequently, there is still the intention for a future research which will attempt to find a common ground among them. That being said, I will address each topic all through this article, relating them to the theoretical approach adopted. At first, I present the creativity model to be taken into account in this research, the social background that will be investigated (social vulnerability). Following it, a notion of perspective and the confrontation of the subject's social condition placed in the aforementioned background.

The theoretical guideline chosen for this study is a concept of creativity designed by Glaveanu (2010, 2015), that emphasizes an approach based on cultural psychology, in which the sociocultural context has a strong influence on the development of creativity and it bears a relational nature.

The author proposes a model of analysis for creativity named 5 A's (actor, action, artifact, audience ad affordance) (Glaveanu, 2012). It is structurally based on the conceptual model from Rhodes (1961, as cited in Glaveanu, 2012).

The selected context for this study concerns a background of social vulnerability. It is known as a scenario in which subjects placed in a fragile social reality, live singular existences. Even in such conditions, some get involved in activities that nourish and stimulate creativity. However, one may notice that within these social groups there are exclusionary practices, which are historically formed, as well as the creation of new postures adopted by the subjects. As a result, it is noticeable that some cultural communities may adopt two positions: vulnerability (poor life condition experiences) or resistence to their condition (Souza & Pulino, 2016). Likewise, the subject creates survival possibilities even when facing resource shortage, making use of creativity, as a tool, and their culture, as mediator.

According to Glaveanu, Hanson, Baer, Barbot, Clapp, Corazza Henessey, Kaufman, Lebuda, Lubart, Montuori, Ness, Plucker,

Palmon, Sierra, Simonton, Pereira e Sternberg (2019), creativity and culture are linked: the former uses signs and tools made available by the latter in order to produce new cultural resources that will ease future creative acts. Bearing that in mind, here is a question: Which factors contribute to the development of creativity in subjects placed in this peculiar cultural interactions?

II.   CREATIVITY AND PERSPECTIVE

It is a great challenge to analyze the factors that contribute to the development of creativity in subjects placed in environments of social vulnerability. Facing unfavorable social conditions makes the subject gather internal resources so that he is able to handle such adversities. Regarding this fact, the authors Cunha, Jakob, Hogan e Carmo (2006) assure that the degree to which subjects are able to deal with adversities or risks will depend on the variety of resources to be gathered, besides their adaptability to be used.

In this case, it is relevant to take into consideration the notion of perspective. It challenges both mentalistic and individualistic conceptions associated with creativity. Such perspective is of relational nature, manifesting itself in the way people engage within and in the world and how the world acts on the individual (Glaveanu, 2015).

Hence, the perspectives are not a product from subjects, nor something they have, but what these subjects develop when it comes to the external world. In other words, the reality perceived by a subject will expose the continuing action mark (Glaveanu, 2015). As a result, the actions taken by subjects through perceived reality interfere in their capacity of handling adversities and they can be exposed as divergent thoughts (Acar & Runco, 2012).

III.   SOCIAL VULNERABILITY AND COPING

The act of confronting difficulties suggests the presence of protective factors, for that

reason, it is interesting to consider a discussion between social vulnerability and resilience (Monteiro, 2011).

As a consequence, Cunha et al. (2006) say there is an essential aspect from vulnerability that refers to a feature related to the capacity of how one answers to embarrassing or risky situations. That is, these responses towards risky situations will shape resilience when facing adversity.

Resilience, in this scenario, acts as a tool the subject uses in order to obtaining better quality of life when getting over adversities. "It involves the context in which it takes place, the culture and the collective responsibility. It gives numerous responses when facing different situations" (Barreira & Nakamura, 2006, p. 78, as cited in Angst, 2009).

On the other hand, other situations in which resilience arises are linked to elements concerning the subject's features or family members, his goods and sociodemographic characteristics as well as the social environment in which he is found (Angst, 2009).

Considering the variants presented: vulnerability, resilience and creativity. An empirical research will be carried out with adolescents from a social project, located in a peripheral area in Brasilia. The aim behind it is to check how these students' creative process is. Furthermore, to collect the data a subjective camera will be used as methodological instrument. On top of that, the records from the activities will work as questions redirected towards what was produced.

IV.   CONCLUSIONS

Due to what was presented, it is important to take a deeper and more careful look at the scenario being analyzed. Is it possible to create more inclusive conditions and interactions that support the creativity process in contexts of social vulnerability?

The model of the 5 A's, pointed out by Glaveanu (2012), can offer a more thorough analysis about this interactions, considering the

notion of perspective. Taking into account not only the subjects placed in this context, but also the social environment, the actions e the artefacts which are mobilized when confronting adversities and the resilience development.

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Qualitatively Different Ways of Understanding Creativity: A phenomenographic investigation of Japanese Adolescents' Conceptualisations of Creativity in the Visual Arts

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Summary

Keywords: Creativity; Visual Arts; Arts Education; Japanese Culture; Phenomenography; Dimensions of Variation; Cross-disciplinary benefits.

I. INTRODUCTION AND AIMS

PISA's recent decision to include a creative thinking domain in their 2021 exam assessment scheme (Organisation for Economic Co-operation and Development, n.d.) indicates the increasing global recognition of the value of fostering creativity in school age students. Traditionally, creativity research has been largely dominated by a product-oriented notion of creativity attributed to a Western interpretation and often investigated through quantitative methods. The scope to investigate the relationship between cultural context and conceptualizations of creativity is limited in such research. The dominance of a product-oriented notion of creativity may also misrepresent non-westerns understandings of creativity and hence place students from non-western contexts at a disadvantage in international assessments such as PISA.

Recently, there is growing consensus amongst creativity researchers regarding their social responsibility to support understanding of creativity that is inclusive of cultural diversity and the importance of this for education (*Glaveneau, Hanchett Hanson, Baer, Barbot, Clapp, Corazza, Hennessey, Kaufman, Lebuda, Lubart, Montuori, Ness, Plucker, Palmon, Sierra, Simonton,Neves-Pereira, Sternberg in press*). There is a need for empirical studies of how students in East Asian cultural contexts, such as in Japan, conceptualize and experience creativity in specific academic disciplines. So far, very few studies have been conducted to provide an empirical account of how student understandings of creativity in Visual Arts are connected with their perceptions of learning more broadly and the perceived benefits beyond school life.

This presentation reports findings generated from a phenomenographic investigation of how students' conceptualisations of creativity are related to their perceptions of education and of future career benefits. It follows on from a previous paper on what Japanese students understood creativity to be constituted as and how they discerned it from what it isn't. (Karnilowicz Mizuno, 2018; Karnilowicz Mizuno, Xu, in press)

II. LITERATURE REVIEW

Cross-Cultural studies comparing the creativity of Western and Eastern individuals tend to report western participants as more creative. However, investigations of German, Chinese and Japanese teachers' conceptualizations of creativity (Zhou et al 2013) indicate different understandings of creativity. Investigation of Japanese student conceptualizations of creativity indicated that while student descriptions of creativity varied, they primarily associated creativity with a thinking process rather than product-orientated notions of creativity typically seen in the Western literature. 'Making' and 'emotional freedom' or 'a sense of liberty' were also evident in students' conceptualization of creativity. Furthermore, Japanese language and cultural norms as well as student experience with traditional and non-traditional Arts were significant influences on students understandings (Karnilowicz Mizuno, Xu, under review). Further investigation of the mechanisms underpinning student understandings and how these relate to their perceptions of education more broadly could be helpful in designing curriculum and assessment tools that support the fostering of creativity that is inclusive of diversity.

III. QUALITATIVELY DIFFERENT WAYS OF UNDERSTANDING CREATIVITY

Individual and group interviews were conducted with 14 student members of extra-curricula Art and Shodo (Traditional Japanese Calligraphy) activities at a co-educational middle and senior high school in Tokyo. Inductive analysis of the interview data was conducted to map the variations in student understandings of creativity in relation to the Visual Arts. This revealed eight Dimensions of Variation, representing critical differences in how creativity is understood:

A: Creativity 'exists or not' or 'exists in degree of strength'.
B. Creativity is determined by 'self' or as 'coming from a relationship between self and society'

C. Creativity is related to 'continuing tradition' or 'challenging tradition.'
D. Thinking intrinsic to creativity is understood by 'how it relates to concept' and/or 'execution of pictorial elements'.
E. Creativity is understood as thinking related to 'Process' or 'Process and Product'
F. Creativity: 'Development of Emotional Intelligence' and 'Acquisition of Learning Skills related to Metacognition'.
G. Creativity is 'development of something innate' or 'creativity is developed'
H. Creativity related to the visual arts 'has limited cross-disciplinary benefits' or 'has cross-disciplinary benefits' of something innate' or 'creativity is developed'

Relationships between the dimensions suggested that how creativity was conceptualized is dependent on the gender of the participants and the art forms that the participants engaged in. The Japanese cultural context and language, as well as the Arts disciplinary contexts were found to shape these understandings. The findings from the study also highlighted the perceived cross-disciplinary and future career benefits by the student participants.

IV. CONCLUSIONS

While current creativity tests tend to use divergent thinking as a key indicator of creativity, students in this study did not emphasize the importance of a large quantity of ideas with creativity. Instead they tended to associate the process of giving birth to something new with thinking independently and refining an idea. In contrast to the understanding that creativity is an innate trait that is difficult to enhance as reported in studies of Japanese teachers (Zhou, Shen, Wang, Neber and Ikuma 2013), the students in this study believed that creativity could be developed. Most students felt creativity as understood in the arts had cross-disciplinary benefits for other subjects, particularly the humanities. They also felt that formal study in the visual arts fostered both creativity and related skills that would be beneficial for future careers. Only a few

students felt the cross-disciplinary benefits of creativity were limited and they tended to associate creativity with mastering of technical skill rather than of the conceptual content.

The findings illustrate the critical points of difference in the Japanese adolescents' conceptualizations of creativity in relation to the Visual Arts. In this study, the methodology of Phenomenography allowed opportunities to examine the relationship between the Japanese context and how the students apprehended creativity. In particular, it demonstrates the ways in which the Japanese language and cultural norms together with training in traditional or non-traditional art forms mediated the construction of these understandings and shaped students perceptions of how these linked to their broader experience of education future careers.

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Innovative Behaviour. An empirical research in Italy

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Summary

Keywords-component: Innovative Work Behavior; Creativity ed Economic and Social Sciences; Human Resources Development; Innovation in Economy and Business; Phenomenology of Innovation

I.   INTRODUCTION AND AIMS

This contribution introduces the results of the research project "Innovative Behaviour" carried out during 2018 by an interdisciplinary team of researchers coordinated by Human + Foundation.

The study, through a series of in-depth interviews with 15 Italian innovators, focused on the description of their action patterns, in other word to what extent they generate innovation through specific and recurrent behaviors from which is possible to generalize a system of action.

Comparing their behaviours with those more used in the academic literature (Scott and Bruce 1994; Christensen 2011; Van de Van 2000), the research has highlighted partial confirmation: single behavioural scheme where classified in the three macro-areas proposed by De Jong and Den Hartong (2018). The ideal-type of innovative behavior would be descript in three phases: the first one concerns the generation of idea, in other words the most creative and disruptive moment where ideas are inspired from observation, questioning, associating practices; the second one concerns the championship and idea promotion, through

which the first results of the innovative idea are compared with the opinions of financers, top managers, policy makers; finally, but importantly, the implementation one - in which the idea is experimented and practiced (Christensen et al 2011; Del Torre 2008, Colaianni 2008)

Furthermore, new findings, such as new kind of action patterns or the impossibility to reduce the behavioural model to a sequential temporal phase, have been found.

II. METHODS

The sample of interviewers was selected thanks to the methodological tools elaborated during the research "Innovative Spirits", carried out by Human + Foundation in 2017. The study applied, on a sample of 1237 participants belonging to 14 different organisations, a questionnaire in order to measure their innovative skills and personal characteristics. The questionnaire considered, for each interviewed, four factors to evaluate the innovative spirit: "capacity", i.e leadership style, collaborative approach; "motivational structure", i.e risk appetite, need to be

autonomous; "values" such as procedural justice, social utility; "personality", i.e. resilience, optimism, self-esteem.

Moreover, as a monitoring tool but also a procedure to increase the qualitative information generated by the questionnaire, the research implemented a peer nomination procedure that elected 85 persons from the general sample as the most innovative, according to their colleagues' opinion. Among those who were nominated, we selected The 15 individuals with the higher innovative potential - measured through the questionnaire - and we interviewed each of them as a single case study in "Innovative Behaviour" project.

III. RESULTS

The content analysis of the interviews allowed the generalization of 24 recurrings behavioural schemes: on the one side the explorative and generative ones, where the innovation expresses itself in a chaotic, divergent and prolific way; on the other side, the promotional and practical ones, where innovation expresses - instead - a urge towards the brevity, pragmatism and resilience. The model of innovative behaviour that emerged as a relevant output of the Innovative Behaviour research was circular (Anderson 2014), iterative, not easily predictable but cultivable in the work organization through learning and training tools.

One of the main research's aim is to enforce the innovativity of companies, non-profit association and public administration proposing an innovation academy, a multidisciplinary process of learning based on the findings of the research, potentially useful to discover, cultivate and also protect the innovativity.

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Music and divergent thinking: is only a matter of notes?

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Summary

Keywords-component: Creativity; Divergent Thinking; Music; Visual; Verbal; Domain-Specificity; Expertise

I. INTRODUCTION AND AIMS

Creativity plays a key role in a wide range of human activities and is considered a window for well-being at any age (Palmiero, Nori & Piccardi, 2017). It is a multifaceted phenomenon that involves different cognitive and extra-cognitive processes. Amongst others, the combination of convergent and divergent thinking represents one of the most useful framework to account for creativity. Whereas convergent thinking involves the ability to find one single solution to a closed problem, divergent thinking is used to find different solutions to the same open-ended problem. Thus, divergent thinking is based on ideational fluency and represents an index of the creative potential (Runco & Acar, 2012).

It is unclear the extent to which creativity and divergent thinking rely on domain-specific or domain-general components. Although creativity may be domain-general (e.g., Milgram & Livne, 2005; Silvia, 2008), only a few people show high levels of creativity in different domains (Baer, 1998).

By consequence, the idea that divergent thinking is also domain-specific gained support across years. For example, verbal divergent thinking is mostly domain-specific (Palmiero, Nakatani, Raver, Olivetti Belardinelli & van Leeuwen, 2010), whereas visual divergent thinking is only domain- and task-specific (Palmiero et al., 2010; Palmiero, Nori, Aloisi, Ferrara, & Piccardi, 2015). Also motor divergent thinking was found to be domain-specific since developmental age (Palmiero, Giulianella, Guariglia, Boccia, D'Amico, & Piccardi, 2019).

This evidence suggests that both general and specific domain contributions underpin creativity and divergent thinking (e.g., An & Runco, 2016). This view is also confirmed by the neuro-imaging evidence (Boccia et al., 2015), showing that creativity and divergent thinking in musical, verbal and visuo-spatial domains is supported by both multi componential neural networks and specific brain regions. Interestingly, brain areas activated during musical improvisation were found to overlap mainly with those of verbal divergent thinking, and in minimal part with those of visuo-spatial creativity and divergent thinking. These findings confirm that musical training improves especially verbal and visual abilities, as a consequence of the plastic changes in brains of musicians (for a review see Rodrigues, Loureiro & Caramelli, 2010).

With this in mind, the level of specificity-generality of creativity and divergent thinking con change according to expertise. In the present study, the issue of the domain-generality/domain specificity of divergent thinking was faced using a group of musicians, that were tested in musical, verbal and visual divergent thinking. The idea was to clarify if the expertise in music selectively supports only music or if it can yield advantages also in verbal and in visual domains. Hypotheses were formulated as follows:

1. musicians produce comparable performances in musical, verbal and visual divergent thinking domains (domain-general hypothesis or full-transfer domain hypothesis);
2. musicians produce comparable performance only in musical and verbal domains as compared with visual divergent thinking domain (musical-verbal transfer-domain hypothesis);
3. musicians produce comparable performance only in musical and visual domains as compared with verbal divergent thinking domain (musical-visual transfer-domain hypothesis);
4. musicians produce higher performance in musical domains with respect to verbal and visual domains (domain-specific hypothesis).

II. METHODS

Sample - 33 musicians [Mean age = 36,7 (11,34); age range = 18-65; F = 9; M = 24; Mean years of expertise = 10,27 (4,8)] were enrolled. They were recruited from two different colleges of music located in Palermo and Formia, Italy. As first instrument musicians used piano, or guitar, or trumpet, or violin. They were all healthy and had no history of neurological or psychiatric illness or drug/alcohol abuse. All signed an informed consent. The study was approved by the Ethics Committee of University of L'Aquila in accordance with the Declaration of Helsinki.

Tasks – Three different tasks were administered to all participants in order to measure musical, verbal and visual divergent thinking. The musical divergent thinking task was opportunely developed. It consisted in producing as many as different musical traces using the incipit of 'Happy Birthday' as a starting point. Traces were firstly produces using a pentagram and then reproduced by the preferred musical instrument. The verbal divergent thinking task consisted in producing as many as different uses for cardboard boxes (Sprini & Tomassello, 1989; Torrance, 1978). The visual divergent thinking task was the

figural completion task starting from given stimuli: participants were instructed to add details to the given shapes in order to complete drawings and then give a title to each of them (Sprini & Tomassello, 1989; Torrance, 1978).

Procedure – Participants were first introduced to the general procedure of the experiment, then signed the informed consent. The three divergent thinking tasks were administered randomly. Each task lasted 10 minutes. Participants were encouraged to produce alternative ideas until the time was available.

III. RESULTS

Scoring – The three divergent thinking tasks were scored in
terms of: 1) fluency (the number of musical, verbal and visual ideas provided); 2) flexibility (for the musical task: the number of rhythmic/melodic categories encompassing the musical traces produced; for the verbal and visual tasks: the number of conceptual categories encompassing the relevant verbal or visual ideas); 3) originality (the sum of the originality weights computed across the ideas provided; each idea could be scored 0, 1 or 2 points, according to the originality strength; for the musical task three expert musicians scored the traces (the inter-rater agreement was satisfactory); for the verbal and visual divergent thinking task the scores were attributed following the norms included in the technical manual.

Results – Three univariate ANCOVAs were carried out, using the scores (fluency, flexibility and originality) of musical, verbal and visual divergent thinking tasks as within variables. The musical expertise (in years) was used as covariate. The Bonferroni's correction was used as Post-Hoc. Regarding 'fluency' [$F_{(2, 62)}=4,26$, p=,018], musicians scored higher in verbal divergent thinking than both musical and visual divergent thinking. Regarding 'flexibility' [$F_{(2, 62)}=4,10$, p=,02], and 'originality' [$F_{(2, 66)}=3,17$, p=,048], musicians scored higher in both musical and verbal divergent thinking than visual divergent

thinking. In addition, for 'originality', an interaction effect of domain x covariate was significant [$F_{(2, 62)}=4,02$, $p=,023$].

IV. CONCLUSIONS

Results highlighted that musical experience enhances mainly verbal divergent thinking. Fluency was higher in verbal domain probably because it was easier to provide ideas in terms of alternative uses of a cardboard box. Flexibility and originality were higher in both verbal and musical domains as compared with visual domain. Since no differences were found between musical and verbal domains in terms of flexibility and originality, the present study supports the second hypothesis. This means that musical and verbal divergent thinking can share common processes and mechanisms. In addition, these findings are also more consistent with the domain-specific rather than with the domain-general approach, because it appears that the divergent thinking ability does not develop in a domain that involves different cognitive abilities, such as the visual one. Finally, it should be noted that musical expertise seems to be important in conveying originality in both musical and verbal domains, that is, the quality of responses is triggered by the type of knowledge and procedures developed across years.

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Keynote Speech

Friday, June 21, 2019
17:45 p.m.

Vlad Petre Glăveanu
Webster University, Genève, Switzerland

The possible: A theory

In this talk I will propose and discuss a sociocultural (pragmatist and dialogical) theory of the way in which we engage with the possible in our daily lives. In this context, the possible designates those areas of our experience that are outside our 'here and now' but can, through different processes, be brought into our current experience of the world, enriching it and, ultimately, transforming it altogether. These processes include meaning making, perspective taking, what if and as if thinking, imagination and wonder, among others. The theory of our engagement of the possible builds on the previously proposed perspectival model of creativity (Glaveanu, 2015) and is grounded in the notions of difference, position, perspective, and dialogue. In the end, a reformulation of creativity as acting on possibility will be proposed and some concluding thoughts offered on how, when and why we should cultivate the possible in our existence and that of others.

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Keynote Speech

Saturday, June 22, 2019
09:30 a.m.

Mathias Benedek
University of Graz, Austria

Cognitive neuroscience as a window on creativity

The human brain has the remarkable capacity to imagine things it has never seen, and to solve problems it has never encountered before. Cognitive neuroscience offers powerful tools to study the creative brain at work, which has already provided exciting insights in the neural mechanisms underlying creative cognition. This presentation gives an overview of recent developments and advancements in this field, including neuroscientific investigations of the role of memory, attention, and cognitive control in creative thought. It advocates a theory-driven approach, in which cognitive neuroscience complements other lines of research to better understand human creativity and the functioning of our brain.

SESSION 7

Gating in' Creativity:

A study on the Psychophysiological Basis of Creativity in Primary School Children

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Summary

The current study investigates whether highly creative children and children with attentional problems show more 'leaky attention' as measured with the sensory gating EEG event related potential P300 and Mismatch Negativity. Research implies that highly creative individuals have reduced sensory gating, which causes them to perceive more and different stimuli from the environment. This more diverse stimulus set in working memory can then be used to optimize creative outcomes. Data collection under 90 children aged 9 to 12 is currently in progress. The first results from the 2x2 ANOVA with creativity, attention and their interaction as between subject factors will be presented and discussed during the conference.

Keywords-component: EEG, Creativity, Attention, Inhibition, MMN, P300, Sensory Gating

I. INTRODUCTION

Creative individuals seem, in general, to be more easily distracted and associations between creativity and symptoms of ADHD have been reported (Carson, Peterson, & Higgins, 2003; Gonzalez-Carpio, Serrano, & Nieto, 2017). As such, creativity might be regarded as a positive consequence of distractibility (Carson et al., 2003). This link between creativity and distraction (or weakened attention) may be explained by the premise that highly creative individuals have a broader attentional focus because their sensory gating mechanism is less active. This may cause them to perceive different and more stimuli compared to less creative individuals, leading to more affordances to act creatively (Zabelina, O'Leary, Pornpattananangkul, Nusslock, & Beeman, 2015). In the brain, this phenomenon of lowered sensory gating is associated with lower levels of cortical arousal. (Boutros & Belger, 1999). In other words, sensory 'gating-in' is the phenomenon of lowered attentional filters and increased leaky attention and is thought to be beneficial for creativity (Eysenk, 1967). Sensory 'gating in' is thought to be reflected in the Mismatch Negativity (MMN) and the P300 amplitude (Friedman, Cycowicz, & Gaeta, 2001; Winkler, 2007). Since few empirical studies exist regarding the effect of early neural attentional processes on creativity (Carson et al., 2003; Zabelina et al., 2015), the current study investigates how sensory gating mechanisms relate to creativity and attention in a population of primary school children.

When novel or deviant stimuli are perceived, the human brain will automatically shift attention towards those stimuli. This is evident by a negative deflection in the frontocentral activity of the brain, the so-called MMN amplitude (Winkler, 2007). MMN has been extensively studied in schizophrenic patients, due to its relation to attention and inhibition. For example, decreases in MMN appear related to paying more attention to irrelevant cues and representation errors (Morris, Griffith, Le Pelly, & Weickert, 2012; Hong, Tunano, O'Neill, Hao, Wonodi, McMahon, Elliott, & Thaker, 2008). Furthermore, patients with schizophrenia are more likely to be creative (Power et al., 2015), which further implies a shared neurocognitive mechanism of sensory gating.

MMN is usually followed by a positive amplitude named P3a. The P3a reaches maximal amplitude in the frontal areas of the brain. Comparable to MMN, it is elicited by a deviant stimulus in a sequence of identical (standard) stimuli and is related to bottom-up scanning of the frontal attentional resources (Polich, 2007). Similar to MMN and creativity, research on the relationships between creativity, P3a amplitude, and attention is lacking. However, it appears that P3a is related to cognitive flexibility and task-set shifting (Polich, 2007), which are important aspects of creativity (De Dreu, Nijstad, & Baas, 2011). In addition, P3a and attention are also known to be related (Bramon, Rabe-Hesketh, Sham, Murray, & Frangou, 2004; Smallwood, Beach, Schooler, & Handy, 2008).

Based on the literature described above, we expect that highly creative children and/or children with attentional difficulties will show reduced sensory gating as shown in reduced MMN and P3a amplitudes in an auditory oddball task compared to children that are less creative.

II. METHOD

From a largescale behavioral study on creativity, mathematics and executive functions, 30 highly creative children (based on the top 20% scores on the Test for Creative Thinking Drawing Production; Urban, 2004), 30 children with attentional problems (based on the top 20% percent scores on Strength and Difficulties Questionnaire, subscale hyperactivity-inattention) and 30 typically developing children (with scores between 20 – 80 % for creativity and attention) between the age of 9 and 12, will be selected to perform in a mismatch negativity paradigm (an auditory oddball paradigm), amidst other psychophysiological paradigms. The mismatch negativity paradigm consists of four types of stimuli. There are standard tones, which are presented most frequently. In addition, three types of deviant tones will be presented, which vary in duration and/or frequency. We will use the midline electrodes Fz, FCz and Cz to analyse the MMN amplitude and FCz to analyse the P3a amplitude. Three MMN waves will be constructed by subtracting the averaged standard ERP from the three averaged deviant stimulus types per individual, the maximum individual MMN amplitude and the maximum P3a amplitude. The P3a amplitude will be scored in the non-attended deviant trials. We will run a 2x2 ANOVA with attentional problems, creativity, and the interaction effect as between-subject factors and MMN and P3a amplitude each as dependent variables. To prevent alpha inflation, we will only perform further (post-hoc) tests if the ANOVAs showed appropriate significant differences.

III. RESULTS AND DISCUSSION

Data collection is currently in progress. We will present and discuss the first results at the conference.

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Unrevelling the time-course of ivergent thinking: Effects of 10Hz and 40Hz tACS stimulations on the serial order effect in divergent thinking

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Summary

Keywords-component: creativity, divergent thinking, serial order effect, transcranial alternating current stimulation (tACS), alpha, executive processes, Alternative uses task (AUT)

I. INTRODUCTION

Divergent thinking (DT) is a thinking process often associated to the generation of original ideas, which is based on the exploration of diverse possible alternative responses and it is involved in many creative efforts (e.g. Runco & Jaeger, 2012; Kaufman, Plucker and Baer, 2008). Analyzing the time course of DT, it has been shown that, as time passes, the number of ideas (fluency) decreases while the originality of ideas increases. This phenomenon is known as *serial order effect* (Christensen, Guilford and Wilson, 1957). Past literature suggests that this effect is related to the use of different strategies during divergent thinking with the initial productions driven by an experiential strategy, where memories of past experiences were retrieved from memory leading to the production of obvious, common responses, while the generation of the following

alternatives is based on a semantic strategy, where conceptual combinations are used to generate original responses (Gilhooly, Fioratou, Anthony and Wynn, 2007). In recent years, the serial order effect has been analyzed according to the controlled-attention theory of creative cognition (Beaty, Silvia, Nusbaum, Jauk and Benedek, 2014), which considers DT to be a top-down process that involves different executive processes. According, Beaty and Silvia (2012) demonstrated that fluid intelligence (Gf) moderates the serial order effect. Furthermore, Wang, Hao, Ku, Grabner, and Fink (2017) suggested that three main executive processes could be imputed to be responsible for the serial order effect during DT tasks: shifting, updating and inhibition. According to these authors, the temporal dynamics defining these different executive processes seems to contribute to create the serial order effect in DT. However, results on the specific role of the diverse executive functions are controversial. Recent behavioral results revealed that higher and lower shifting individuals exhibited different serial order effects in DT; however, such differences were not reflected in the cerebral activity recorder through EEG. On the other hand, EEG alpha activity during a divergent thinking task seems

to be sensitive to the role of individual differences in the inhibition executive function (see Wang et al., 2017 for details). While alpha activity, especially in the frontal and parietal regions, has been consistently associated to creative performance during a divergent thinking task (Fink & Benedek, 2014), its role for the emergence of the serial order effect is still not clear. Moreover, evidence on the relationship between alpha activity and individual differences in executive function for the occurrence of DT temporal dynamics is still scant.

The general aim of the present study is to explore the causal role of alpha activity over the frontal and parietal regions for the emergence of the serial order effect in DT, taking into account individual differences in different executive functions. Activity in the alpha frequency band (8-12 Hz) in the frontal and parietal regions has been associated to the temporal dynamics in the generation of an original ideas (Schwab, Benedek, Papousek, Weiss and Fink, 2014; Rominger, Papousek, Perchtold, Benedek, Weiss, Schwerdtfeger and Fink, 2019). Specifically, in highly creative individuals, the generation of an original idea is associated to an initial increase in alpha activity, which has been related to an attention shift toward internal processes such as the retrieval of past memories. During this initial stage a weak functional coupling between frontal and parietal areas emerged. During the end of the process leading to the generation of an original idea a further increase in alpha activity emerged, which is associated to a strong coupling between frontal and parietal sites, and which seems to indicate a high prevalence of executive control functions supporting complex mental simulation. These results seem to suggest a different role of frontal and parietal regions during the time course of idea generation. In the current study, we specifically explored the role of alpha activity in the frontal and parietal regions for the emergence of the serial order effect in DT by using a 10Hz transcranial alternating current stimulation (10Hz-tACS) over the prefrontal (similar to Grabner, Krenn, Fink, Arendasy and Benedek, 2018) and parietal regions. Changes

in time dynamics in idea generation as a consequence of these stimulation are evaluated by administering an Alternative Uses Task (AUT) (Guilford, 1967). Our main hypothesis is that both 10Hz-tACS stimulations in prefrontal and parietal areas compared to sham condition and to stimulation control conditions (a prefrontal 40hz-tACS and a parietal 40-hz tACS) can affect the time-course of participants' idea generation during the divergent thinking task. We therefore hypothesize an increase of participants' creative performance through the modulation of the serial order effect induced by stimulation of alpha activity over the frontal and parietal regions. Based on recent literature (Agnoli, Zanon, Mastria, Avenanti and Corazza, 2018; Wang et al. 2017; Beaty et al., 2012), a further hypothesis is that the modulation of the serial order effect could emerge as a function of the individual differences in executive functions and in creative achievement.

II. METHODS

The experimental design includes two experiments, each with a sample of 30 healthy first-year university students in the range between 18 and 30 years. The two studies are identical in the experimental procedure. The only main difference is that in the Experiment 1 a 10Hz-tACS stimulation is used, while in Experiment 2 we deliver a 40Hz-tACS stimulation. As in past research (Lustenberger, Boyle, Foulser, Mellin and Fröhlich, 2015) this procedure is used to exclude the possibility that tACS (independent of the stimulation frequency used) or electrical stimulation in general could affect divergent thinking. In both experiments, a randomized crossover design is applied, and participants are blinded to the stimulation condition. We indeed apply a within-subjects experimental designs developed over three consecutive days, during which participants are involved in the following three conditions: 10Hz-tACS (Experiment 1) or 40-Hz tACS (Experiment 2) stimulation over the prefrontal cortex (F3 and F4, bilaterally, according to 10-20 EEG mark system); 10-Hz tACS (Experiment 1) or a 40-Hz tACS (Experiment 2) over the parietal cortex (P3 and P4, bilaterally); sham stimulation (non-stimulation

control condition) for both experiments. Participants perform the AUT task in each of three days for the duration of the stimulation conditions (27 min). Specifically, participants are asked to generate and to report orally ideas for nine AUT trials. Each of these AUT trials lasted exactly 3 minutes. The responses of the participants will be then scored by fluency, originality and flexibility (based on Guilford, 1967; Runco & Okuda 1991). In both experiments, the following tasks and tests are included to control for individual differences in executive functions: the letter-memory task (Miyake, Friedman, Emerson, Witzki, Howerter and Wager, 2000; Morris and Jones, 1990) to assess "updating" function; the number-letter task (Rogers and Monsell, 1995; Spector and Biederman, 1976) to assess "shifting" function; the Stroop color-word-interference task (Stroop, 1935) to measure the inhibition of prepotent responses ; the short form for the Raven Advanced Progressive Matrices Test (Arthur & Day, 1994) as a measure of Fluid Intelligence (Gf). Finally, we administer a series of questionnaires to define participants' creative profile: the Creative Activity and Accomplishment Checklist (Okuda, Runco and Berger, 1991), the Short Scale of Creative Self (Karwowski 2011) and the Visualization-Verbalization Questionnaire (Richardson, 1977).

III. RESULTS

Data acquisition is underway. Preliminary results testing the aforementioned hypotheses will be presented at the conference.

IV. CONCLUSIONS

In conclusion, the present study contributes to the growing body of research interested in explaining the phenomenology of the serial order effect in DT in consideration of both the cerebral dynamics characterizing DT and different executive functions. Furthermore, this study could provide additional insights on the usefulness of the tACS stimulation technique as a methodology to improve DT performance.

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Switching categories: brain activity underlying flexibility during idea production

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Summary

Keywords-component: creativity, divergent thinking, Alternative uses task, cognitive flexibility, EEG, Alpha

I. INTRODUCTION

Creativity is commonly defined as the ability to produce work that is potentially novel (original, unique), and useful (Sternberg & Lubart, 1996; Corazza, 2016). Creative ideation is typically assessed by divergent thinking tasks, based on the notion that thought "goes off in different directions" (Guilford, 1959). A typical example is the alternate uses (AU) task, which requires participants to think of many different alternative uses for a conventional object (e.g., "brick"). Besides ideational fluency and originality of ideas, AU task performance is often quantified with respect to the flexibility dimension (Amabile, 1982), which reflects the number of switches between conceptual categories (Acar & Runco, 2017; Acar et al., 2018).

Neuroscientific studies on creative ideation using human electroencephalography (EEG) have shown robust evidence that frontal and parietal (of the right hemisphere) EEG alpha power is particularly sensitive to various creativity-related demands involved in divergent thinking, in particular when creating ideas with high originality (Fink & Benedek, 2014). Up to now, it is still an open question whether EEG alpha power can be modulated by flexibility during creative ideation.

The present study aimed, therefore, to explore the EEG correlates underlying ideational flexibility. We particularly addressed the following question: Are alpha activity patterns different when switching to a diverse category than staying in the same category? Based on previous studies showing that adopting new strategies or building novel combinations of stored knowledge are mediated by prefrontal cortex (Dietrich, 2004), we expect to find an involvement of prefrontal regions (in addition to parietal regions) during switching categories as compared to staying.

II. METHODS
Participants

Twenty participants between 20 and 25 years (M_{age} = 22, *SD* = 1.8; all females)

recruited at the University of Bologna took part in the study.

Alternative Uses Task (divergent thinking)

A modified version of the Alternative Uses Task (AUT) was used in the present study. Participants were in particular instructed to sequentially produce four different alternative uses for everyday objects in four distinct generation periods. Participants were therefore required to provide four different alternative responses (i.e., R1; R2; R3; R4) to the same object in four distinct idea generation intervals (i.e., IG1; IG2; IG3; IG4).

EEG Recording and pre-processing

The EEG was recorded with a BrainAmp DC amplifier (BrainProducts GmbH, Germany) from 61 electrodes mounted on an elastic cap (EASYCAP GmbH, Germany), according to the 10/10 system. EEG data were processed off-line using EEGlab v13.4.4b and custom functions developed in MATLAB. Mean alpha power was first computed in the interval between -2.5 and -0.5 seconds before the production of each response and then averaged across epochs to measure task-related power (TRP) change in each channel Positive TRP values reflect increases in alpha power from the reference to the activation interval (i.e., alpha synchronization), whereas negative values reflect decreases in alpha power (i.e., alpha desynchronization).

Data analysis

For statistical analyses, electrodes were aggregated for the left and right hemispheres in anteriofrontal (AF), frontal (F), frontocentral, centroparietal (CP), parietotemporal (PT), and parietooccipital (PO) regions. Alpha TRP values were analyzed using two separate generalized linear mixed models (AR1 covariance structure) and treated as dependent variables. POSITION (6 levels: anterifrontal, frontal, frontocentral, centroparietal, paarietotemporal, and paretooccipital), and HEMISPHERE (2 levels: Left, Right) were entered in the models as within-subjects factors, whereas FLEXIBILITY (2 levels: Category Switch, Category Stay) was entered as a between-subject factor. Finally, two-way and three-way interactions between the previous variables were added to the models.

III. RESULTS

Analyses revealed that during creative ideation higher task-related synchronization of parietal alpha activity was observed. Moreover and interestingly, as compare to category stay, alpha power during category switch was more pronounced over frontal regions (of the left hemisphere) as compared to parietal regions.

IV. CONCLUSIONS

The present study investigated whether EEG Alpha power could be modulated by flexibility. Results provided a first evidence that Alpha activity during switching categories is specifically characterized by an involvement of frontal (of the left hemisphere) regions as compared to staying categories. Moreover, higher alpha power over parietal regions (of the right hemisphere) was observed, confirming past research on creative ideation. As a whole, these findings are in line with the view that frontal alpha synchronization reflects a selective top–down inhibition process that inhibits incoming external input.

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SESSION 8

RISE – A new framework of Creative Education

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Summary

Keywords-component: frameworks of Creativity, Creative education

I.   INTRODUCTION AND AIMS

There is increased interest in incorporating creativity into education systems around the world. Despite creativity being a well-established field, there is lack of definitional consensus within education systems and their curricula. Teachers often lack knowledge and skills in creativity, as there is little professional development available for teachers to help them teach both with and for creativity in the classroom. This presentation explores the current state of creativity in education and reports on the development and implementation of a new Framework of Creative Education, called RISE (Result, Investigation, Student, Environment). The RISE framework of Creative Education is based on well-established research and theory in the creativity field, newly applied to education.

II.   THE ROLE OF CREATIVITY IN SCHOOL EDUCATION

There is a clarion call from countries around the world for creativity to be an integral part of school education (Cremin & Barnes, 2018). Countries from Australia (ACARA, 2010) to Iceland (MESC, 2011) to Estonia (Republic of Estonia Ministry of Education and Research, 2014) to Hong Kong (HKCDC & HKEAA, 2007) are introducing creativity into their classrooms (Jeanneret et.

al., 2018, under review). This presentation will focus on the role, purpose. and practice of creativity in education, proposing a new framework enabling teachers to understand creativity as a construct within education, and to teach both with and for creativity in their classrooms (Beghetto, Kaufman, Baer, & Patston, 2017; Jeffrey & Craft, 2004). The RISE Framework also provides scope for teachers to integrate creative skills and attitudes into existing curriculum.

V. In order for teachers to offer creativity in their classes, they must first understand what creativity is and why it is both helpful and necessary. Creativity can be a concept beset by myth and misunderstanding (Plucker, 2017). In addition, teachers hold misconceptions and implicit beliefs regarding the personal qualities of creativity in students (Gralewski & Karwowski, 2016). Although misconceptions may be relatively unimportant in the general population, it is concerning if teachers lack an understanding, or more importantly, hold erroneous beliefs, about something being introduced to the classroom (Patston et. al., 2018). The professional development materials available for teachers allay miconception and flawed implicit beliefs.

III.   THE STUDY

A three phase process was undertaken over four years to develop and implement the RISE Framework.
Phase 1 – Development of the Framework
The RISE Framework of Creative Education has its origins in the 4Ps Framework of

creativity (Rhodes, 1961), and provides teachers with the knowledge to develop the skills of teaching with and for creativity. The language of *Person, Process, Press* and *Product* has evolved into the more accessible language of *Result, Investigation, Student* and *Environment.* The RISE Framework identifies and combines the factors of creative education as evidenced by the literature, providing teachers with a depth of understanding which they can apply in their subject area. Creativity is domain specific (Baer & Kaufman, 2017), and requires prior knowledge and skills relevant to the domain (Cropley & Cropley, 2005). Integrating creativity into existing curriculum so that it can be practiced and developed through content (Beghetto & Kaufman, 2009) allows teachers more flexibility than if creativity is taught as a discrete subject. Each component of the RISE Framework is applicable to any existing school subject.

Phase 2 – Professional Development of Teachers

In order to address implicit misconceptions and offer teachers explicit skills in Creative Education, the RISE Framework was introduced through the professional development program at a four campuses school in Australia. The RISE Framework Modules were offered through a blended learning approach (Harris, Connolly & Feeney, 2009), combining online instruction with face-to-face collaborative meetings. There were two modules, each consisting of six lessons, approximately thirty minutes, of online learning, followed by thirty minutes of face-to-face discussion. These were delivered over a school year.

Phase 3 - Trial and Implementation

The RISE Framework has been trialed in a range of subjects, including English, Maths, STEM, Geography, Physical Education, Agriculture, Religious Studies, Music, German, Chinese, Legal Studies and Business Studies. The modality was to introduce concepts and skills of creative education into existing curricula. Projects have involved teachers using more creative approaches to their pedagogy, teaching with creativity, and developing explicit skills of creativity in their students, teaching for creativity (Jeffrey & Craft, 2004).

IV. CONCLUSION

Preliminary findings suggest that the RISE Framework is an effective tool for teachers to teach both with and for creativity in their classrooms. The concept that creativity is context specific and may be applied and develop through the lens of any subject has resonated with teachers. Phase 4 of this project is to gather data on the efficacy of the components of the RISE Framework in improving the creative capacities of both students and teachers.

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What influences willingness to online collaborative learning of pre-service teacher after experiencing it?

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Summary

Keywords: Pre-service teachers; Willingness to Online Collaborative Learning (OCL).

I. INTRODUCTION AND AIMS

Online collaborative learning is an essential skill needed both for teachers and pupils, in other to integrate into 21st Century's demanding skills. The learning process, the group partners interaction and the ending learning product are of great importance when considering how to instruct pre-service teachers to acquire this pedagogical technique and its posterior inclusion in their classes.

(OCL) relates to a teaching-learning model which emphasizes an online collaborative discourse and IT-based knowledge building (Tyagi, 2104). Ku, Tseng, & Akarasriworn (2013) found that learners' satisfaction is influenced by the way they perceive the co-operation quality. This in turn, is influenced by: the quality of communication among the group members, the trust they develop in each other, and their sense of interconnection. All these factors affect learner's motivation and their willingness to further promote the learning tasks. Yücel & Usluel (2016) acknowledge the collaborative online writing challenges. These include diverse cultural values content, difficulty in displaying social and cultural openness, tolerance and respect for others' views, and the need to be flexible. Based on Cognitive Orientation theory (CO), Kreitler & Margaliot (2012) examined four types of beliefs: on myself, on how things happen, on a desirable state and on a goal.

The purpose of this study is to understand, following previous OCL experiencing, which are the factors that influence pre-service teachers' predisposition for using OCL, both for studying and for teaching purposes. The survey's questionnaire was developed in Israel by the authors based cognitive orientation theory. It includes closed and open questions on the attitudes and beliefs about OCL.

II. METHOD, PARTICIPANTS AND PROCEDURE

Participants included 57 pre-service students in two different OCL pedagogic courses. The course subjects were: Issues in Teaching and Lesson Planning. In each course, participants were asked to divide into groups and submit two tasks. The first was to to describe and analyse a teaching approach and upload a cooperative discussion document to the course site. The second task was to prepare two learning activities based on two different teaching approaches according to the theoretical material of the first task. Data collection was done after completing the course. The qualitative analysis was done in two stages. In the first stage we embedded participants' answers according to CO Theory adjusted to OCL, namely, (a) beliefs about one's self OCL's functionality; (b) beliefs about OCL during the experience; (c) beliefs about the ideal functioning; and (d) beliefs about OCL'S goals. At the second stage, we extracted three themes about willingness to OCL.

III. RESULTS

The three themes that may predict posterior inclusion of OCL method both for studying and teaching are: Effective functioning: collaborative writing process, and relevance of the task. In each statement, only three types of beliefs were found, as indicated in parentheses. Letter marks refer to four types of beliefs' in OCL.

Effective functioning consists of (beliefs a, b and c): confidence on their ability to function effectively in this environment (a); reliance on peers functioning (b) and participation which contributed to task's promotion; belief that participants behaviors in OCL should be as it is (c).

Collaborative writing process consists of (beliefs b, c and d): an experience of respectful and pleasant atmosphere as well as fair distribution of the investment and contribution to the discussion (b); belief that this type of learning should be conducted in openness to peers' opinions and point of views that contribute to personal knowledge growth (c); and belief that the social skills development in learning product cooperation, and the sense of belonging (d).

Relevance of the task consists of (beliefs a, b and d): pre-service teachers who perceived that the online assignments were relevant to their classes' performance (a); that believe in the collaborative product' relevance for their training (b) and regarded OCL groups work will empower them in their future professional development (d).

IV. CONCLUSIONS

The potential value of OCL activities is unquestionable. The OCL learning environment plays an important role in today's demanding abilities. Not only because learners progress in their social interaction with their peers, but also because they construct meaningful knowledge, advance in developing themselves and their peers by building models for judging and building information. These in turn are essential skill to integrate into 21st Century's workforce. Hence, teachers, as skills' builders, shall understand how to use this pedagogical tool and under which conditions OCL shall be carried out optimally. Results show that willingness to participate in OCL, and posterior implementation in regular class, depend on group dynamic, peers' attitudes, and meaningful knowledge building. Thus, when planning, designing, developing, and managing a whole OCL course, class, or task, educators shall bring to mind these factors. It is also desirable to introduce participants into the difficulties that may arise during the studying process and prepare them for their challenges. To teach them tolerance and to understand that each participant's contribution differs in approach and quality form other peers.

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Creativity in a crossroad: the potential impact of education, creative self-efficacy and aesthetic judgment in establishing a complexity matrix for a contemporary understanding of the construct

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Summary

Envisioning creativity as a systematic and intrinsic feature of the complexity of psychological structures, we hope to highlight the importance of education and creative self-efficacy in approaching creativity as inherently multidimensional and socio-culturally situated.

Keywords-component: creativity, education, creative self-efficacy, aesthetic judgment, complexity of psychological structures, psychological development.

I. INTRODUCTION AND AIMS

In a world disturbed by profound societal changes, the socio-cultural-economic model at use seems to be wavering at the abyss – as a result of its ineptitude to provide credible answers to the challenges of contemporary societies. The illusion created by a possible mere appearance of casting a new light on creativity (and on other notions in the same semantic constellation, as is the case of innovation) as if creativity could be the ultimate stronghold capable of envisaging social and economic problems and challenges has shown a quite iniquitous stance. The result can be expressed by a skillful rhetorical construction rather than by a conceptual advance. Accordingly, the educational realm has been particularly shaken, mostly as a consequence of the exposure to Western educational systems' frailties (Craft, 2011; NACCCE, 1999), urging a profound reflection about the true place and role of creativity that, eventually, overcomes a functionalist, problem–solving perspective, evolving in the direction of a multidetermined, multidimensional, developmental, dynamic and embedded in a complex system alternative.

Acknowledging the contributions of Dewey (1889/1953, 1916/1997), Read (1943/1945) and Eisner (2002a, 2002b), and focused in (but not confined to) the Portuguese reality, we intend to explore the impact of creativity in education, specifically in the modes it is (or not) intentionally and systematically fostered in nowadays kindergarten and basic education *curricula,* as well as the ensuing impact in teaching practices and in students' psychological development.

II. CREATIVITY, EDUCATION, AESTHETIC JUDGMENT AND CREATIVE SELF-EFFICACY: FOREVER (UN)TANGELD

However tangled creativity and education seem to share a tumultuous and antithetical relationship. Thus, we find *curricula* focused in promoting skills directed to unquestioningly and functionally fulfill a task in a normative way, in place of promoting critical thinking and decision making abilities that might prove to be a differentiation factor in the real world (Hondzel & Hansen, 2015) and a stimulus to an individuation construction, instead of normalization. Indeed, they continue to promote standardization and simplification in lieu of searching new ways of blooming the idiosyncrasies of every individual into a more diverse and complex

educational framing. Yet this normalization route seems to be condemned to instil a disquieting sense of disarticulation between education and the real world, where the capacity to creatively construct world(s) of meaning in a future of difficult prevision is an indisputable need. Therefore, rather than portraying creativity and education as antithetical, contemporaneity appears to demand an active intersection of the two, being aesthetics an arguably important link. Hence, we chose to focus in aesthetic judgment considering it brings psychological development to the equation, framing creativity in a multidimensional picture where it appears to emerge as an outcome of the complexification of human psychological structures (instead of a trainable skill) by widening developmental horizons and empowering the management of self–regulatory dimensions, like self-efficacy. In this sense, creativity is a structural attribute of the provisional outcomes of psychological development – like flexibility or complexity – not a discrete, specific and trainable by repetition skill.

Configuring an agentic perspective of the individual, Bandura (1997) refers to self-efficacy as a characteristic of a dynamic psychological structure able to confidently face unexpected challenges and define goals and expectations grounded in possibility thinking (Craft, 2002), unveiling the connexion between creativity and self-efficacy. As a matter of fact, the two appear to be very much entwined since the ability to self-motivate and persevere are almost *sine qua non* conditions for success in the creativity realm. Therefore, it is not unexpected to observe the plethora of arguments asserting the importance of self-efficacy in the educational domain (Klassen & Usher, 2010; Pajares & Urdan, 2006). Ergo, approaching creative self-efficacy from a developmental, socially and culturally situated point of view may prove to be noteworthy to the scientific discussion surrounding it.

III. RESEARCH DESIGN

In order to grasp the aforementioned multitude of dimensions of creativity, we designed a mixed methods research whose goals were defined around the analytical distinction of three curricular levels: explicit *curriculum*, implemented *curriculum* and acquired *curriculum*.

Hence, the first phase implied a documental analysis of Portuguese legal norms, regulations and available governmental curricular programs in search for the reference to creativity. The second phase materialized in a focus group with teachers working with students in the kindergarten and basic educational school levels, during which we tried to explore how creativity is, actually, present in Portuguese classroom practices, as well as the participants' perception of how the Portuguese education system promotes creativity.

Finally, the third phase involved gathering data that could emanate creativity as emerging from a complex psychological structure, underlining the impact of our elected contextual factor: school. Therefore, creativity, aesthetic judgment and creative self-efficacy were explored in our sample of 393 students enrolled in kindergarten and basic education levels in a group of public schools from a Portuguese district. This implied the adaptation and validation, through confirmatory factor analysis, of the Portuguese version of the Creative Self-Efficacy Inventory (Abbot, 2010). It also implied resorting to the Consensual Assessment Technique to obtain a measure of creativity based in the assessment of a total of 786 drawings of a tree and a flower. Moreover, involved the random choice of 48 participants from the main sample, for a semi-structured interview [based in the Aesthetic Judgment Ability Test (Bamossy, Johnston, & Parsons, 1985) and in the original interview structure of Parsons (1987)] which aimed to determine their aesthetic judgment level.

IV. FUTURE INTERSECTIONS

Considering that, to our knowledge, this intersection of concepts has yet been explored, by presenting our results first-hand to the scholar community, we hope to contribute to a productive discussion about the true nature and place of creativity in contemporaneity, particularly when framed by an inherently psychological, openly developmental and profoundly ecological

perspective, that emphasizes the inexorable relation between creativity and education.

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SESSION 9

Purpose: The 7ᵗʰ P of Creativity

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Summary Keywords: creativity; communicative value; actions; purpose; creative process; communication process.

I. INTRODUCTION AND AIMS

Creativity can be a controversial, challenging yet fascinating concept. Summarized by Lubart (2007) as the capacity to produce something both at the same time new and appropriate in a given context, it can raise questions on how to define who or what is creative, as well as where, when and how something or someone can be described as creative.

Given this complexity, Kozbelt, Beghetto and Runco (2010) have criticized theoretical approaches that only consider significant yet less frequent expressions of creativity – big C – and, thus, exclude other forms of creative expression by ordinary people in their daily lives – mini C and little C – or work – pro C. The authors considered the four aspects of creativity – person, process, product, and place or press – and emphasized that each of these is usually approached in isolation, and not in conjunction with at least one of the others. In order to further enrich approaches to this phenomenon, the authors added potential (Runco, 2003) and persuasion (Simonton, 1990), totalizing 6 aspects that enhance the "communicative value" (Gruber, 1988, p. 264) of the typology by making it easily memorable through alliteration, while allowing a broader range of productions to be approached as creative.

However, these additional aspects will not lead to any significant progress if too much time is spent selecting the most appropriate approach for which social and cultural variables do not become relevant alongside individual factors. It is certainly more complex to deal with a larger number of variables (Csikszentmihalyi, 1996), which results not only in more aspects, but also more contexts of creative expression, especially considering this cannot be sufficient if aspects are dealt with in isolation, or if joint consideration of aspects does not account for dynamic interactions between them (Glăveanu, 2012) or involve actions, whether identified – or even valued– as mental or "bodily". Given the above, what is the best way to approach creativity based on actions?

INTRODUCING THE 7ᵀᴴ P

Gruber (1989) considered work to be creative if it is "(1) original, (2) purposeful on the part of the creative person, and (3) harmonious or compatible with other human purposes." (p. 04). Assuming that "creative products are the result of purposeful behaviour" (Gruber, 1999, p. 94), purpose goes hand in hand with knowledge and affects the relationship between the personal and collective issues through which purposes themselves – and even personal purposes – are shaped. Therefore, these are also built – and altered – over time, which can raise questions relating to individual intention through productions, as well as in relation to what is considered to be relevant by the creator. The answer can arise from an understanding of the

related instances – of individual, productive, professional, familial and sociohistorical context (Guber, 1999) – and also depend on what is valued as creative in each instance, or in other words, on the way creativity is understood and put in practice in a given time and place, as well as on the limits to subverting established values.

Values guide and motivate each individual by providing meaning – a way of assigning value – not only to specific productions, but to sequences, groups of productions or even entire routines and their outputs. In the 5 As typology (Glăveanu, 2012), *actions* can materialize as *artefacts,* which will take on a meaning according to the interactions between *actors* and audiences, as well as among the various aspects of creativity, throughout all stages of the creative process. Therefore, they also involve *affordances*, mostly related to the shared values in a given context that may or may not allow given actions and meanings to these actions (Gibson, 1986), and that can provide a basis for intentions or strategies for creativity, as well as actions in response to these.

Whether created, maintained, constrained or changed over time, purposes become an essential part of the interrelated communicational and creative processes, as long as they can "make the actions connect" cognitive and emotional issues with the "outside", as part of a two-way street with flows in both directions that vary in content, intensity and influence. This means that these are not merely individual issues – in spite of the relevance of the affects that make purposes specific ways of dealing with collective values, for example – but that in the same way as motivation (Hennesey, 2016), they are constituted social and culturally, changeable through communication even in contexts of creation, and hard to measure. However, the purpose of this paper is not to provide an analysis or criticism of measurment itself, but to propose methods of approaching creativity based on purpose, albeit listed in typology form.

Therefore, particularly when it comes to contexts of creation such as those taken from an empirical study involving a task of divergent thought followed by the different stages of development of a creative product (Formiga Sobrinho & Sanmartin, 2018), it is possible to assume that the university courses to which the students belonged – including design, fashion, adversing and cinema – somehow worked as domains and influenced the meaning and enjoyability of the task, while shaping the students' purpose as they developed different thought-based tasks. The differences in the answers enable researchers to analyze these by attempting to identify the personal characteristics of each student and collective factors of each group, in order to ask: "whose are" these purposes?; do they "belong" to someone, everyone, or no one?; and finally, what is the point of the 7th P of creativity, if purpose does indeed reach this point?

BESIDE THE 7 Ps, THE 5 As

Creativity is still normally dealt with as a cognitive phenomenon, and the focus of studies inevitably returns to individual factors. However, Glăveanu *et al.* (2019) emphasize a collective effort toward social and cultural approaches and invite other researchers to contribute to the enrichment of creative research in this direction.

Most existing studies include a range of contributions, such as: questioning the status of creativity, since its meaning changes in different places (Celik, & Lubart, 2016), or even in the same place at different moments; and considering that a creative person or product will certainly benefit, but also pay the price for acquiring, keeping or missing out on certain achievements. Therefore, how can focusing on purpose based on goal-oriented actions make a difference to approaches toward creativity?

Following a similar argument, domains such as advertising and design, for example, can be better distinguished from one another mainly according to purpose, and not just products or the other – sometimes unhelpful – Ps. Therefore, focusing on this investigation

into purpose – which is closely related to potential, persuasion and other Ps, as well as action and other As – can allow approaches to creativity from a social interaction perspective, which are influnced by cultural values that guide both communicational and creative processes. The question that remains concerns the methods that should be used to conduct this kind of research, and examples of this are provided.

II. Conclusions

Is purpose the 7th reason why creativity should be studied? Is it the last P of creativity? This study does not provide a conclusive answer to the matter, indeed it is not known whether more or fewer Ps are required to improve this approach or if this is even necessary. The same applies to the As – of which no additional examples are proposed. Both of these are potentially very useful typologies that can be used to approach creativity, depending on how they are applied. Thus, choices must be made, directions must be taken and conclusions must be drawn, even if these still need to be questioned and revisited to make important changes.

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Ethnography as a Creativity Research Method.

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Summary
Ethnography, Creativity, Context, Socio-Cultural

Ethnography, simply put, is the study of tribes, habits, and cultures. It is a look into the social world that tries to reveal why people do what they do. Designed to explore cultural phenomena – the researcher observes action from the subjects perspective. The intention being to translate behaviour into wider understandings about an individual's culture, standards, and background, therefore contextualising their actions. This is achieved by relocating "a particular slice of social action into something larger, into a whole way of life" (Machin, 2002). Establishing a vivid social context encourages us to put ourselves into someone else's shoes to better understand their activities. The reasoning for more ethnographic forms of research, rather than more customary question-and-answer methodologies, is because people do not generally have conscious access to the reasons why they behave in particular ways; especially with regards to creative process. "They are not conscious of the cultural tool kit through which the social world is made meaningful to them". This understanding justifies the importance of observing people in their day to day lives rather than just asking them questions about it. With regard to its uses in observing creative process, ethnographic methodologies will be vital tools in recording qualitative socio-cultural influences, behaviours and outcomes of the creative process amongst individual practitioners.

Across four different texts, creativity is referred to as a sociocultural construct (Csikszentmihalyi, 1996), an innovative idea (Kelley, 2001), an interpretation of personal 'genius' (Tusa, 2003), or as an ability to "transfer knowledge from one setting to another" (Leadbeater, 1999). An investigation of 90 articles on creativity, from top peer-reviewed journals, discovered only 38% offered a conclusive definition (Plucker, *et al.* 2004). This demonstrates a general acceptance of the ambiguous nature of the word since the majority of theorists have, understandably so, avoided defining the very term they are researching. In a similar study, Henrikson details some similarities between texts; noting how a number of common definitions would agree on elements of "value", "newness" and "effectiveness but after this - the majority of opinions would almost always diverge towards varied theories applicable to different practices, individuals or domains (2011). It is seemingly the flexibility and cross-disciplinary value of the subject which inhibits its ability to be easily observed, recorded or even recognised. Within *Advancing Creativity Theory and Research: A Socio-cultural Manifesto* twenty scholars, representing diverse lines of creativity research, collectively agreed upon Creativity as a phycological, social and material phenomenon. The group asserts creativity as a multidimensional act that exists and functions within, for, and from, a socio-material space. This, in my opinion, is an incredibly broad – and correct – description. Creativity persists through domain, discipline, institution and personal perspective; It is a concept that permeates all facets of a socially constructed

reality.

Quickly abridging the manifesto - creativity can be understood as: *culturally mediated, relational, meaningful, fundamental, dynamic in meaning, dynamic in practice, an expression of similarities, an expression of differences, and in need of specification*. The manifesto highlights each individuals unique/different interpretations of the subject as a key element of what constitutes creativity. In this respect, Creativity is somewhat defined by its nebulousness. The variety of definitions reflect this. There are numerous languages, cultures, codes and understandings at work that contextualize and explain creative action. In order to progress creative research, and wide-spread understanding of the subject, we must express creative findings in ways that can be commonly understood. Not as unanimous, universal truths but as useful, open-to-interpretation ideas. The reasoning here is that Creativity is uniquely interpreted person to person. So our research should reflect understandings that allow for this.

Reflecting on our personal understanding of creativity could result in a better understanding of ourselves. If creativity is each practitioners interpretation, or perspective, on the world digested, incubated and expressed in a form relevant to the context, space and time they inhabit – it is not beyond reason to conclude that creativity is an expression of 'self'. More commonly recognised as individuality. This is not to say there are not similarities in individual understandings or external factors and influences; any semblance of agreement on the subject is evidence of this. Industries, domains and disciplines can be interpreted as collective understandings of creativity. They constitute the spaces and contexts that can be used to interpret it. These socio-cultural constructs allow individual creativity to be perceived, recognised and valued. This idea is best demonstrated by Csikszentmihalyi's Creative Practice Theory (1996), in which he uses the domain, field and person to illustrate

the process of creative submission and review. Csikszentmihalyi's assessment illustrates how creative process is reliant on, or dictated by, the interplay between the individual and their surroundings. An interaction that is seemingly crucial in instigating the realisation of creative ideas. If "creativity cannot be separated from its recognition" is it then a subject that, by nature, needs to be observed to exist?

Although, there is not a single series of mental steps that comprise creativity, as everybody's process is different, it is theorised that there are "common threads" that "seem to run across boundaries of domains and individual idiosyncrasies" (Csikszentmihalyi, 2014). These 'common threads' might well constitute the core characteristics of what it takes to achieve creativity. To identify important 'threads', ethnographic observation of individuals across a number of creative fields could discern some idiosyncrasies that persist cross-domain. Therefore, better understanding what it takes to achieve creativity. A concern often raised is that different processes and techniques might not translate beyond their domains. People assume that a comedian writing a joke might share little with a blacksmith shaping metal. This assumption, though possibly true, separates the two processes within our subconscious. We view comedy and metalwork as separate entities. This gap caused through the separation of disciplines can, in this context, be understood as a *boundary*. These boundaries serve as a source of disruption in the study of creativity as they restrict the free flow of ideas across domains. They frame the act of creativity within a strict context in which it cannot expand beyond. It has been noted that "every domain has its own internal logic, its pattern of development, and those who work within it must respond to this logic" (Csikszentmihalyi, 2014). It reasons that once part of an 'internal logic' we are subconsciously trapped within that domain. Thereby limiting our perception of innovation to having only two routes of

approach; firstly, success through conformity, or secondly, rebelling against it. In this state of mind, we never consider to reimagine the domain in its entirety. There is an implicit expectation and directional context, within domains, that can alter, or inhibit, creative responses. It is often forgotten that "some of the most creative breakthroughs occur when an idea that works well in one domain gets grafted to another and revitalises it". This suggests a number of solutions to creative problems lie outside of the domain in which the problem exists, and within domains that we currently deem unrelated.

Ethnographic reports on creatives from multiple disciplines, fields and backgrounds will help proliferate the free flow of creative processes. Sharing and analysing others practises will help demonstrate both the socio-cultural influences and practical real-world processes used to achieve creative action. The wishes of the aforementioned manifesto are also addressed; ethnography would physically record demonstrations of the similarities, differences, actions, constructs, frameworks, understandings and dynamism of the subject. If creativity is recognised through our difference from one another – we can even consider each report with a dialectical view; furthering our own understanding of creativity by what we do not share with others. Shared terminology insinuates ethnography's inherent similarity to creativity: The two are 'iterative-inductive' processes as each 'evolves in design through study' (O'Reilly, 2009). One is considered a phenomena the other a processes designed to observe them. Both incite a need to ignore preconceptions, and avoid seeing things through just one specific lens. There is a mutual need for self-reflection and awareness of inhabited space. Both are reliant on the creation of unique feedback loops developed by context, experience, and interaction. This natural link between the research method and the area of study encourages a methodology that is self-aware, reflective, and thorough.

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Creativity is Conversation?

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Summary

Organizational leadership, creativity is conversation, design-thinking, collaborative-learning, ingenuity, innovation, community learning centers, youth development, education.

I.   INTRODUCTION

The depth of academic studies vary as to the precise theoretical meaning of creativity as it has been discussed from various perspectives from fields such as: humanistic psychology, philosophy and socio-culturalism, cross-culturalism, multiculturalism, undergraduate university students, parents, K-12 teachers, educational administrators, and brain cognition, offering an array of small qualitative, quantitative and mixed methods literature without agreement to meaning across disciplines.

Richard and Mishra (2018, p. 45) recognized creativity as an essential skill for 21st Century educational development to find solutions to complex problems. The International Society for Technology in Education (ISTE, 2014) included standards as a "framework to create innovative learning environments" (ISTE, 2019). A digitally, supportive learning environment supports multiple perspectives, students as active participants in creative and *fun* activities (ISTE, 2019). The 21st century student can also use math and science technology in design-thinking process for innovative approaches, in real life or *imaginative problem-solving* (ISTE, 2019).

Growing concern about at-risk youth without supervision in large urban areas, between the hours of 3:00 P.M. and 6:00 P.M. show a juvenile crime during after school hours (Montgomery, 2017). Local community leaders are collaborating with libraries and youth centers to provide creative arts, science and technology, and recording-engineering professionals in more than 200 programs nationwide (Montgomery, 2017). Each program seeks to provide safe spaces, meaningful opportunities and partnerships in Creative Youth Development (CYD).

There are five themes embedded in this review of literature: (1) Perspectives on Creativity; (2) Domains, Characteristics and Traits of Creativity; (3) Climate and Orientations in Creative Development; (4) Environments Influencing Creativity, and (5) Leadership Role Supporting Environments for Creativity in Education.

This literature review seeks to find guidance in quantitative and mixed methods frameworks to effectively answer the question: How does the literature in this study and other case studies reveal another definition of creativity— a conversation between the intangible and the tangible? How can future creativity researchers improve communication in our collaborative engagement, creative climate and environment?

Historical Background on Creativity and Innovation

At a presentation before an international conference Glăveanu (2017) describe the historical context of creativity from Antiquities

through the ideals in the Renaissance, a time of traditions in mastery. Romanticism was an era with traditions of free flow of thought, exploring the bizarre (Amabile & Pratt, 2016).

In recent studies, international scholars advise researchers to rely less on U.S. and Westernized perspectives, which may diminish cultural norms and their own creative methods (Glăveanu, 2018; Smith, 2018). Vedic philosophy, a catalyst for creativity refers to creativity as "Vac (Word)" used for an individual's total immersion in creative activity from the idea to the manifestation (Raina, 2015), and Veda holds a unitive view of consciousness and creative coexistence. The process of creativity includes many facets in the nature of truth, rising beyond one's own perspective to a higher view of consciousness, using intuition. insights as conversation.

Religious orientations, as with other divergent and convergent orientations, influence the views of the artist, the viewer, and/or the societal reaction. It is one's nature to strive for higher consciousness, empathy and dynamic new insights expressed "in all fields and disciplines" (Raina, 2015, p. 55; Bonshek, 2007, p.26). When tangible ingenuity agitates, divinely inspires, repels and challenges the social norm, the *degree of bizarreness* may get labelled evil or madness in the context of the dichotomy of sacred or profane (Eliade,1959; Raina, 2015, p. 54).

Native American pictographs, carvings, tools, art and artifacts are creative symbols as words, telling an indigenous story affected by religious history (Rood, 2011). Native Mestize's codecs explain the multidimensional science through the transcendental art in oral histories (Andalzúa, 2012).

This literature review suggests greater empirical and case studies among creative youth development centers, tribal language centers, and *third spaces* (Alexie, Alexie & Marlow, 2009) may help to negotiate inclusive conversations improving creativity pedagogy by student teacher immersion in various cultural learning environments.

PERSPECTIVES ON CREATIVITY AND INNOVATION

The depth of academic studies vary as to the precise meaning of creativity, and most agree it is a social construct.

Creativity and innovation should not rely exclusively on psychological assumptions methods of definitions (Amabile, 2016). Humanistic psychologists (Raina, 2015), stretch cross-cultural appreciation for processes that enhance intrinsic intangible values, and individual need for meaningful reflection. Raina explores the extrinsic tangibles of collective connectedness to find mutual meaning, through creativity for social justice.

Socio-cultural conversations seek to protect individuals and cultures' expression through societal norms at the macrocosmic level (Glăveanu, 2018). Confucius beliefs favor creativity for expressing the intangibles, such as, personal growth over revolution, interconnectedness over isolationism, meaningfulness over novelty, tradition over change" (Glăveanu, 2018, p. 30), all of which, appear as a meaningful conversation with oneself, with others in various domains of creativity, and with their nation.

Educators might find the core value underlying conscious and unconscious aversions to creativity, when psychologists or ethnographers converse, careful consideration may shift creative conversations to safe and meaningful expression (Montgomery, 2017). Intergenerational trauma studies found new (Anderson, 2015; Rubin, et al., 2016) and ancient ways (Raina, 2015; Anderson, 2015) to converse about artistic expression as both illness and cure. Creative youth development models appear to have addressed the mental health issue by supporting artistic expression with self-sufficiency support and social services (Montgomery, 2017).

Authors in this literature review seek to find international trends in the growing interest in creativity, some of which embed meaning within the context of nationalism, globalism, consumerism, and ethnocentrism. Richardson and Mishra (2017) share among at least 50 other studies, the need for correlative study toward standardized meaning of creativity and innovation, where results of studies in creativity can be collaboratively measured, whether locally or globally.

Some orientations in teachers assume creative expression traits are a negative behavior compliance problem (Çelik, et al., 2016). Çelik found bilingual orientations negotiate nonverbal cues and holistic subtleties to find the meaning from differing core values that drive creative expression. In the workforce, creative ideas are met with rejection with some colleagues whose orientation exhibits uncertainty avoidance and/or preference to retain status quo (Amabile and Pratt 2016) orientations. Informal mentorship and apprenticeship opportunities, such as the craft creativity domain (Glăveanu 2017) increase mentorship/apprenticeship conversation across domains during the process from intangibles to tangibles (McCarthy, Chen, & McNamee, 2018).

Cognitive and behavioral concerns surface in the conversational tension between orientations (Hughes, et al, 2018). Much like conflict and collaborative management, innovation managers are facilitators and mediators to a creative process, focused on progress in life skills, while improving the product (Montgomery, 2017; Richardson & Mishra, 2018). F

II. CONCLUSIONS

The literature review suggests creativity has a much broader, more meaningful definition as conversation. Creativity as conversation explains why creative youth development blossomed during large immigration settlements in America in the late 1800s (McCarthy, 2018). Creativity is a conversation between intangible insights and tangible externalities immersing oneself or a group in the free flow of ideas, and creative expression.

I welcome participation as consortium research project including international scholars where we can collaborate on the theoretical framework that creativity is conversation. Cross-discipline scholars can exchange data findings gathered in the field, primarily in rural and distressed urban areas, within mobile creative youth, family, student teacher development centers (CYDs) with compatible, interactive scholarly designed technology.

Further study in supportive environments can guide the design of hybrid centers, third spaces, converting library spaces for co-active learning to deepen intergenerational engagement models (Rubin, 2016) and intercultural competencies (McCarthy et al., 2018). New project studies can guide: (a) physical portable infrastructure; (b) adaptable solar design, water, wind and biofuel energy onsite systems; (c) easily relocatable modular construction; (d) sustainable and flexible interior mobility with multiple-use adaptability; and, (d) networked mobile bandwidth and satellite capacities for cohort student immersion in rural regions (e) safety zones from violent conflict and abuse.

I invite collaboration from the creativity researchers in the most effective methods of quantitative and qualitative approaches to further study this new definition of creativity—a conversation between intangible and tangible across domains to refine pedagogy, improve creative expression, collaborative engagement, creative climate and supportive environments

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Keynote Speech

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Team Social Processes and Team Creativity and Innovation

For the past two decades, creativity and innovation have been viewed by researchers as critical to organizational success and survival. Understanding the factors that facilitate or inhibit creativity and innovation at the individual level has been the focus of much of the research in the area. In recent years, research in organizational psychology and management has focused on understanding creativity and innovation in teams. However, while earlier work on teams and creativity has focused on the team as a context variable, and individual creativity as the outcome, more recent research emphasizes creativity as the outcome. The more recent attention to teams has occurred because many of the problems facing organizations are complex, and cannot be solved by a single individual, and these problems require creative and innovative solutions. In this presentation I will discuss our current knowledge and future research needed in relation to team social processes that influence team creativity and innovation.

SESSION 10

CREC (CReativity in Everyday life Challenges), a new cognitive stimulation programme for patients affected by Mild Cognitive Impairment: a pilot study

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Summary

Cognitive stimulation, Mild Cognitive Impairment, Divergent thinking, Creativity, Neurodegenerative disease, Cognitive Reserve

I. INTRODUCTION

Divergent thinking (DT) has attracted neuroscientists' attention for its potential role in terms of diagnosis and rehabilitation for patients affected by neurodegenerative diseases. Indeed, some recent studies have demonstrated the relationships between DT and cognitive reserve (CR) (Palmiero, Di Giacomo & Passafiume, 2016; Colombo, Antonietti & Denau, 2018) that is considered as an essential mechanism for coping with brain damage. Undoubtedly, CR is a pivotal psychological construct for prevention and intervention strategies which try to promote successful aging and slow the onset of dementia (Stern 2002; Stern, 2013). Furthermore, the effectiveness of cognitive training based on creativity has been proved by several meta-analytic research (Scott, Leritz & Mumford, 2004). However, few of these training have been applied to elderly people with neurological disease. This pilot study aimed to preliminary evaluates the feasibility and the possible positive effects of an adapted version of a creativity training, CREC, "*CReativity in Everyday-life Challenges*" (Colautti & Antonietti, 2018; Colautti et al., 2018) in elderly patients affected by Mild Cognitive Impairment (MCI).

II. MATERIAL AND METHODS

In this pilot study, six patients with a diagnosis of MCI were enrolled. The sample was composed of three women and three men (age, M= 73,33 ± 7, 53; educational level, M= 6,83 ± 3,25). Patients were submitted to a 10-session-group training (CREC) that was designed to improve divergent thinking, cognitive flexibility and adaptability in daily life. In fact, this programme is focused on the stimulation of the three mental operations that underlie creative thinking according to the WCR Model (Antonietti, Colombo & Pizzingrilli, 2011): *Widening* patients' point of view, making them aware of the great number of elements that characterize a given situation; *Connecting* divergent elements and combining ideas in uncommon ways and *Reorganizing* the mental field and changing their perspective. Every CREC session was characterized by various activities. In the "*Praxic-constructive exercises*", objects of different nature are utilized (wooden pieces, tangram and geomag)

to specifically stimulate flexible thinking and problem solving skills, giving the patient instantaneous and objective feedback on the strategies activated to respond to the request. In the *"Strange and paradoxical situations",* different scenarios that could happen in the real world under particular conditions, are given. The patients have to find why these conditions occur, moving away from a more automatic answer that may come to his/her mind; in particular they have to widen their point of view exploring the scenario, connect multiple information and reorganize them in order to find the right solution. The task *"Fictitious news or short movies"* involves news on a newspaper or videos on the screen of a laptop. The aim for the patients is to find unconventional and functional solutions to a specific problem, considering it from unusual points of view, stressing again all the WCR processes. Afterwards, the patient was asked to remember and describe similar past situations happened in his/her life and how s/he faced them (autobiographical memory). Finally, an *adapted version of a"Serious Games"* was proposed in order to stimulate patients to think about different and unusual uses of some needed objects on a list; alternatively an *"Alternative uses task"* was proposed, stimulating them to think to the different possible uses of a common object (such as a brick, a shoe, and so on). All the patients were submitted to pre/post-training evaluations. The main outcome measures were changes in: general cognition and specific cognitive functions (measured by a comprehensive neuropsychological battery), divergent thinking (creativity index- CI from the Abbreviated Torrance Test for Adults – ATTA; Goff, 2002) and psychological conditions such as depression, anxiety and apathy. Non-parametrical analyses for two related conditions (Wilcoxon signed-rank test) were performed due to the limited sample size.

III. RESULTS

The preliminary results of this pilot study, with the clear limit of the sample size, show a slight improvement in almost all of the cognitive and psychological measures.

Indeed, qualitative analyses on neuropsychological pre/post tests showed improvements in different cognitive skills. In particular, improvements were observed in memory of single word (*Dubois 5-word test,* pre-training: M= 7.33, SD= 1.03; post training: M= 8.17, SD=1.72), selective attention and speed of elaboration (*Trail Making Test A*, pre-training: M= 44.67, SD= 40.32; post-training: M= 40.50, SD=41.56), divided and alternate attention (*Trail Making Test* B, pre-training: M= 231.67, SD= 213.28; post-training: M= 142.50, SD=194.31), abstract thinking, planning, executive and visuo-spatial skills (*Clock Drawing Test*, M= 6.83, SD= 2.04; post-training: M= 8.00, SD= 1.67) and in the ability to perform a cognitive estimates based on previous knowledge (*Cognitive estimation subtest* from Esame Neuropsicologico Breve, ENB2, M= 4.17, SD= 0.98; post-training: M= 4.67 SD= 0.52). Slight improvements were also observed in the psychological measures. Decreased scores were observed in the scales for apathy (Apathy Evaluation Scale, M= 36.00, S.D.= 9.06; post-training: M= 33.00, SD= 6.10), depression (Geriatric Depression Scale, M= 2.5, SD= 1.76; post-training: M= 1.67, SD= 1.75) and anxiety (Geriatric Anxiety Inventory, M=6.00, SD= 3.69; post-training: M= 3.00, SD= 3.10). Nevertheless, only one measure, that is categorical fluency, which evaluates the strategic recall of words from a specific category, reached the statistical significance showing better performance on the post-training evaluation (*Mdn*= 41.12) with respect to the pre-training evaluation (*Mdn*= 35.34), T= 1.0, p < 0.05.

Furthermore, stimulating DT and cognitive flexibility with this stimulation programme, seemed to have an impact more on cognitive measure such as attention and executive functions, rather than on divergent thinking per

se, which remain substantially stable (pre-training: M=56.17, SD= 5.38; post training: M= 56.5, SD=3.83) in all the indexes considered (fluency, flexibility, originality and elaboration). Definitely, the future research design will include an active control group to ensure that results are not due to practice or expectancy effects.

IV. CONCLUSIONS

In conclusion, this pilot study has demonstrated good clinical results in terms of performances improvement in different cognitive and psychological domains, demonstrating its good feasibility on MCI patients. More subjects are needed to conduct more significant statistical analyses and a research design that will involve at least one active control group is required to define the efficacy of this training programme. However, it seemed that stimulating divergent thinking, cognitive flexibility and adaptability, could be very useful for these patients in order to improve their cognitive reserve which, in turn, can help to better cope with potential brain damage and to give them some instruments to face everyday life problems caused by the new challenges imposed by aging and cognitive fragility. Furthermore, patients who will be enrolled in future groups will be submitted to two more useful scale not being proposed to the pilot group: AD-QoL test (Alzheimer Disease-Quality of Life) which evaluates perceived quality of life and an ad-hoc semi-structured interview which evaluates the perceived usefulness of the training (on a 7-point scale, where 1 = minimum and 7 = maximum; Colautti et al., 2018).

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Utilising Creativity-based interventions to develop positive attitudes towards Mathematics

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Summary

Keywords-component: Emotional Creativity, Developmental Creativity, Mathematical Creativity and problem-solving

I. INTRODUCTION

This study contributed to the field of knowledge regarding 'teaching mathematics creatively' and the impact of such programs on teachers and students. By incorporating both teacher and student experiences with creativity it is expected that greater insight into solving emotional issues such as Mathematics anxiety, attitudes towards Mathematics and gender differences within mathematically based STEM (Science, Technology, Engineering and Mathematics) fields can be proposed. This research has real world implications for teachers, policy makers and students as it will highlight how creativity-based exercises can aid child and teacher development in Mathematics across education systems.

THE ROLE OF CREATIVITY IN MATHEMATICS

It is well documented that Mathematics anxiety negatively impacts teachers and students. The adverse effects of Mathematics anxiety ranges from developing negative attitudes towards Mathematics, to reducing performance on Mathematical tasks and may even affect career aspirations (Ashcraft, 2002). Students experiencing Mathematics anxiety in primary school are influenced by their teachers' attitudes towards Mathematics (Beilock, Gunderson, Ramirez, & Levine, 2010).

The teacher-student interaction of attitudes occurs because students *model* their teachers' behaviour and subsequently develop attitudes based on their teachers' perspective (Bandura, 1974).

Female students experience higher levels of Mathematics anxiety in comparison to male students (Shapiro & Williams, 2012). It is proposed that female under representation in mathematically-based STEM fields is influenced by these early negative experiences with mathematics (Shapiro & Williams, 2012).

Previous research suggests that a key way to develop positive Mathematics attitudes in female students is to target teachers' Mathematics anxiety levels (Beilock et al., 2010). Moreover, longitudinal research proposes that creativity-based interventions are effective in reducing anxiety (Baas, De Dreu, Nijstad, & Cooper, 2008; Byron & Khazanchi, 2011). However, there is a lack of comprehensive research that examines how a

creativity-based intervention within Mathematics affects teachers and students whilst investigating gender differences.

II. AIMS AND METHOD

A mixed method design was employed. The overall aim was to increase attitude towards mathematics using creativity.

Three separate studies were conducted with teachers and students across both primary and secondary school levels.

Study one:

Fifteen interviews with primary school teachers were conducted. Teachers were prompted to provide insight into their own beliefs about the relationship between gender differences within Mathematics.

Study two:

The aim was to understand gender differences in a student's ability to be creative in mathematics and their self-perception of ability.

There were 251 males and 191 females ranging from 10-17 years old. Students were asked to rate their perceived ability to be creative in Mathematics based on the task created by Tidåsen et al., (2015). They were then prompted to be creative. Students were then asked to self-rate a post creativity task as to how creative they felt they were when engaging in the task. Independent judges then scored actual student creativity.

Study three:

A pilot study was conducted with primary school teachers with the aim of altering attitudes towards teaching Mathematics through a creativity-based classroom intervention. Thirteen teachers from primary schools participated.

The creativity-based classroom intervention was based on Cropley's Fostering Creativity in the Classroom General Principles research (1997). Cropley's framework suggests that there are three general principles, 1: 'What should teachers foster in their students?' 2: 'Personality properties favourable for

creativity' and 3: 'Creativity fostering teachers are those who, Cropley suggests, support twenty-four sub principles that contribute to providing a holistic approach to creativity in the classroom. The intervention also emphasized the 4P's (press, process, person and product) definition of creativity. Teachers were provided with resources and techniques to help maintain and encourage all four P's in the classroom. Moreover, the Mathematics component of the interventions were based on the Australian National curriculum for Mathematics in Australian primary schools.

Teachers' attitudes towards Mathematics (Aiken scale) and Mathematics anxiety levels (Maths Anxiety rating scale (MARS)) were quantitatively measured both pre and post participating in the creativity-based intervention and at a 3-month follow up.

III. CONCLUSIONS

Study One:

A grounded theory approach was used to analyze the qualitative interviews with teachers. These results highlighted that teachers explicitly believed that there were gender differences in Mathematics, with males more inclined to be mathematically orientated than females (attitude bias).

Study Two:

Student ability to be creative in Mathematics was measured over a 2-year period and the results suggest that males self-rated creativity (M = 3.3, SD .87) was higher than females (M = 3.0, SD = .76). This difference was statistically significant M = .271, t(432) = 3.491. P=.001 d = .37 (small/medium effect size). However, females held more accurate perceptions of their ability to be creative in Mathematics and judges scored female mathematical creativity (M = 2.2, SD .78) higher than males (M = 2.0, SD = .73). This difference was statistically significant M = .20,

t(444) = 2.9. P=.005 d= .53 (Medium effect size).

Study three:

The results of the pilot intervention suggest that both female and male teachers experienced a decrease in anxiety after engaging in the intervention. However most importantly, positive attitudes increased post intervention for both genders (non-significant difference). Female teachers held more positive attitudes post intervention than males (non-significant difference). Follow up interviews highlighted that teachers felt that the workshops helped encourage attitudes and they viewed creativity as a valuable tool to help teach Mathematics.

The results provide a basis for future research but suggest effective methods for encouraging student and teachers to develop positive attitudes towards Mathematics are needed.

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Symbiotic Design Approach Combining AI and Neuroscience to Spark Human Creativity

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Summary

Keywords-component: AI, Neuroscience, Design, AI, Creativity, Tools, Cognition, Augment

I. INTRODUCTION AND AIMS

'Artificial Intelligence' is a term that is now very common when describing any new research, technique or product. It is accepted that it has unprecedented ability to automate and accelerate processes from hardware manufacturing to finding new pharmaceutical drugs. As a neuroscientist, I'm particularly excited by its enablement of analysing huge amounts of complex temporal neural data - in particular to classify mental cognitive states.

Apart from its analytical and automation prowess, the other common and more dystopic perspective is the fear that AI will replace humans. This fear stems precisely from its potential ability to be generally 'intelligent', and yet the simultaneously held belief that is prevalently comforting, is the belief that it can never breach 'creativity', the last bastion of humanity.

That is not to say that there haven't been attempts in this direction of 'creative AI', ranging from generative adversarial neural networks that have created photo-realistic 'birds' and 'human' celebrities, to Amazon's recently released AI-fashion designer, and current AI-painters inventing new styles. Though even with the last two, I would argue that this is AI being trained on hundreds of thousands of human-created styles in order to reproduce and marginally incrementally improve on what are essentially pre-existing designs. In other words, AI is currently capable of creativity with a small 'c', and not capable of the big paradigm-shifting leaps within creativity with a big 'C' - something which is still firmly within the human sphere, such as the late genius Alexander McQueen.

But why do we want AI to be human? Should we be fearful of its inhuman nature, or think precisely about this ability to help us humans think differently? The building blocks of creativity.

Could AI be designed to work with us in creative symbiosis?

II. MAN & MACHINE CREATIVE SYMBIOSIS

According to NESTA in their Creativity vs. Robots report (Bakhshi, Frey & Osborne, 2015), creativity is inversely

innovation aren't easily replicated by machines currently, so those in the creative industries are in theory, less vulnerable to replacement. In fact, here I will present a specific use case on AI assisting human creativity.

In 2015, I was invited by Queen Mary's University to curate and create an event for their upcoming Globe Poetry Festival - which would feature human poets and also excitingly 'poetry bots', a series of different AI algorithms from different research institutes that were able to generate different forms of poetry from couplets to haikus.

The event I produced followed a classic 'Man vs Machine' protocol in order to see whether in a live participatory setting, 'man' or 'machine' would write a better poem. Within the event itself, the definition of 'better' was quickly re-defined and revealed.

On the 'machine' end, I was working with Dr Stephen McGregor, with his 'metaphor machine' (McGregor, Purver & Wiggins, 2015). We could input 5 or 6 keywords which would then be compared in semantic closeness with other words which were all held within a high-dimensional word embedding structure (this would be calculated from source material that the algorithm would be trained on e.g. 19th century romantic literature). These other words, with their allegorical relationship with the original keywords, then form the basis of the returned metaphor, which for the purposes of the event was then further subjected to lexical and grammatical rules to resemble a poem.

As the event ensued, I realised that what was originally meant to be a fun almost pre-proven point of man's superiority over machine in the

In turn, the human audience then shaped the machine metaphors into poems and forms that were aesthetically and emotionally more appealing to humans…thus completing the symbiosis of Man and Machine.

After all, as Stephen remarked would we as humans really appreciate fully and value truly creative output by AI: 'What would AI be creative about? Being an AI?''

III. NEUROSCIENCE OF CREATIVE FLOW

During my interdisciplinary PhD, I explored the neuroscientific complex systems underlying creativity (Rahman, 2014). I found different neuronal networks and activation patterns corresponded to different actions and cognitive states of musical performance, and found a consistent EEG signature during peak creative improvisational flow, as both self-assessed by the performers and external judges.

The EEG brain activity I identified during musical creative performance, was further supported by researchers using fMRI, not only on musicians (Limb & Braun, 2008) but also in poets, lyricists and rappers (Braun et al, 2012).

realm of creativity, was in fact not the case. Every metaphorical poem produced by the machine in response to human keyword suggestions, was met with surprised appreciation from our human audience, as the metaphors ranged from the esoteric, to the ironic and at times indeed 'thoughtfully' poetic.

What was happening was that unlike humans, the machine was not self-editing itself before allowing an 'idea' to surface as it were. So it was externally visualising ideas a human might initially have thought of mentally but would retain internally, and quickly suppress before they were expressed externally - for any number of reasons ranging from social norms to simply not being able to 'see' the potential fruition of the whole vision.

This all points towards the prospect that the neuronal networks underlying creative flow as people mentally envision their creations in real-time, are common across different domains, whether they are engaged in speaking words, or specialist motor skills performing music.

IV. HUMAN-CENTRED AI DESIGN

A few years later, I have now founded a startup NeuroCreate, where we are building the idea of using AI to enhance human cognition and augment creativity - rather than replace the human mind. Our technology aims to accelerate creative work processes to allow users to be more productive - we make what is known as 'CreaTech'.

Our first product, the FlowCreate™ Innovator, is an AI- powered brainstorming tool and *'Ideas Collaborator'* that gives users real-time suggestions using natural language processing, that are context-specific and relevant to the topics within their ideation sessions. These suggestions are based on design-thinking techniques that enable mental flexibility by deliberately stimulating lateral thinking, and encourage users to consider different perspectives and angles. We've

digitally incorporated tools such as the '6 Hats' and TRIZ.

The FlowCreate™ Innovator, cycles you through different cognitive stages of creativity and problem-solving (Wallas, 1926). Firstly it helps users within the 'Preparation' stage by enabling research-on-the-fly, showing a 'thought deck' that clearly visualises the ideas within users brainstorms, allowing quick combinatorial creative actions, alongside of presenting tailored research and images. The Innovator then augments the 'Incubation' stage by analysing whole ideation sessions to reveal inherent themes. It also non-linearly combines both divergent and convergent creative thinking by allowing users to identify overall commonalities during ideation sessions which they can then organise into moodboards.

V. CONCLUSION

We've had 80 trials across creative agencies, innovation

the quality and efficiency of creative ideation with promising results towards the creative partnership between AI and humans (Table 1). In the games hackathon trial, whereas

Table 1. Summary of results from user trials, where they were asked to rate enabling properties of the FlowCreate™ Innovator from a scale of 1 to 5 (1 being very poor, 5 being excellent)

traditional creative processes timelines would result in a new games design within 1.5 days, in comparison, participants were able to use the FlowCreate™ Innovator to create on average 3 tangible new ideas within 5 minutes.

The results show, that the FlowCreate™ Innovator is allowing a carefully designed symbiotic interaction between AI and humans, that is human-centred and sparks creativity. The design integrates the cognitive neuroscience and problem- solving stages underlying the creative process. We envision as a next stage, to optimise this Innovator and personalise its digital interaction and creative stimuli, via users' own brain activity data and train their creative flow signature through neurofeedback. AI again will play a role, as we are using deep learning models to classify creative flow states from complex EEG dynamics.

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80 User Trials (Scale 1-5)	Creativity Productivity	Mental Flexibility	Product Enjoyment
Fashion/ Design	4.6	4.8	4.8
Creative Agency	4	4.25	4.12
Games Studio	4	3.8	3.55

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Keynote Speech

Saturday, June 22, 2019
16:00 p.m.

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The Impossible: Leonardo Da Vinci

Arguably, Leonardo da Vinci can be considered the most creative individual that ever appeared in the history of Homo Sapiens. Notwithstanding the fact that innumerable books have been written on Leonardo, many aspects of his life are still mysterious, and in many cases his achievements appear to be characterised by the quality of appearing... impossible! It would seem impossible that a single person could work creatively in more than twenty different disciplines. It would seem impossible that the same person produced the most famous painting in the world, La Gioconda, the most famous fresco, Il Cenacolo, invented the helicopter and the tank four centuries in advance of their actual realisation. It would seem impossible that in the fifteenth century times someone could already understand that images on the retina appear upside down, and that the moon was not a source of light but only a reflector. It would seem impossible that all of this and much more was achieved by someone who ignored Latin, the scholarly language of the time, who had no formal education and learned by observation, and who probably had very few people in the world to discuss his ideas with. But all of this happened, exactly 500 years ago: Leonardo left the Earth on May 2, 1519. Let's celebrate genius.

SESSION 11

Screenwriting: Creativity and Creative Practice

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Summary: This paper takes a step towards aligning research from the field of Screenwriting as Creative Practice, with research into Creativity and Neuroscience, to gain deeper insights into the process of creativity as practiced during the iterative craft of screenwriting. It aims to use Practitioner Based Enquiry (PBE) to link research into creativity across domains to move beyond simple task-based measurements of creativity, to provide a deeper understanding of its neural basis and assist screenwriters to develop their creative process.

Keywords-component: Creativity, craft, screenwriting, creative process, script development, creative practice research, Neuroscience, Practitioner Based Enquiry (PBE)

I. INTRODUCTION AND AIMS

The writing of a screenplay requires a mastery of its craft elements including: story, character, metaphor and theme. It also requires the ability to harness the powers of inspiration via the creative process to create a compelling blueprint for the collaborative art of filmmaking. This paper investigates the deployment of creativity and craft in the process of screenwriting to consider how a screenwriter may consciously activate the processes of creativity during their work.

Much has been written about "how to write a screenplay" from the craft perspective (Cooper, 1997, McKee, 1999). Much has also been written from a populist perspective, including filmmaker David Lynch's (2007) insights into the fragmentary nature of creativty and the inspirational power of meditation. However little has been written about creativity and screenwriting outside interviews with practicing screenwriters who provide insights into their creative process via personal anecdote (McGrath & MacDermott, 2003).

Research into the neurobiological bases of creativity is an expanding field and has aligned with other fields in the arena including the "sociocultural, cultural, developmental, educational and historiometrical" (Vartanian et al., 2012, xi). However research aligning the neuroscience of creativity with the research of domain-skilled e.g.. screenwriter academic "creatives" who use PBE to investigate the creative process of themselves and others, is as yet underdeveloped. As Fink and Bendedek note, "the employed creativity tasks used in neuroscientific studies on creative cognition are essentially basic types of tasks" and are "too simple to be generalisable to 'real-life' creative achievements" (Fink and Bendedek in Vartanian et al. 2016, 223).

This paper takes a first step in aligning research into creativity from the field of screenwriting as creative practice research, with research into creativity and neuroscience (Vartanian et al. 2016) and builds on my work in the area of creativity and screenwriting (McVeigh, 2015; 2016; 2019 in press).

II. CREATIVITY, CRAFT AND SCREENWRITING

Research into the individual and their creative processes during screenwriting is an emerging field. In their article, 'Script Development: Defining the Field', screenwriting researchers

Batty, Taylor, Sawtell and Conor, interrogate the definition of script development and note that there is still much research to be done (2017, 240). Batty et al. question: "What development actually entails ... and what tools are used to achieve this?" (2017, 228). Elsewhere in referencing creativity researchers, Wallas (1976), Bastick (1982) and Csikszentmihalyi (1996), Kerrigan and Batty situate screenwriting as part of systemic, iterative and recursive creative processes (2016, 137).

III. SCREENWRITING AS CREATIVE PRACTICE

In the academy, a body of work around screenwriting as creative practice is developing (Batty and Kerrigan, 2018). This research may include investigation by Practitioner Based Enquiry (PBE) methodology which accommodates the pairing of creative practice and research insights in generating valid knowledge in a research context. A PBE approach allows researchers to "enquire into their own practices to produce assessable reports and artefacts" (Murray and Lawrence 2000, 10). In Australia the PBE research artefact, the screenwriting practice PhD, has a strong history which is now growing internationally, including in the UK (Batty and Baker, 2018, 78). In this scenario the screenwriter/researcher writes a screenplay and via PBE methodologies including, for example, journalling, narrative enquiry or ethnographic research, writes an accompanying exegesis which explicates the research "in conversation with the screenplay itself" (Batty & Baker, 2018, 75).

In Screenwriting as Creative Practice research, the methodology of the personal journal is a tool which enables an insider's insights into their own creative processes by recording observations, questions and ideas. As McIntyre contends, "Both the artefact we have made and the journal we keep of our own process would be sources of data to tell us something about the practices we are using"

(McIntyre 2018, 90) about the "constant negotiations are made between the self (ideas, visions, feedback) and the commercial product (script)" (Kerrigan & Batty, 2016, 136).

This paper will build on my previous work investigating screenwriting and creativity, including "Finding the Lightbulb Moment: Creativity and Inspiration in teaching the Craft of Screenwriting" (McVeigh, 2016) and "Work-in-progress: the Writing of Shortchanged" (McVeigh, in print) where I outline case study research I have conducted to reflect on the creative process during the highly iterative and craft-specific domain of screenwriting.

This research project, "Screenwriting: Creativity and Creative Practice", is the next stage of the above research. In this work, I seek to connect the liminal and recursive nature of screenwriting as creative practice, with the field of Creativity and Neuroscience, including the development of metaphor (Vartanian, 2012). Data will be collected as noted above via PBE, including interviews with established Writer/Directors and the journal work of PhD and other screenwriting student/practitioners. This research is controlled by university research ethics processes.

I will seek to align data obtained from reflective creative practice journals as well as personal interviews, to record evidence of the imagination and insight associated with Creativity, and the craft decisions associated with structuring, editing and rewriting, wherein "art, artistic talent and skill are critically interwoven into the artistic formula" (Zaidel in Vartanian et al. 2016, 133).

— CREATIVITY AND NEUROSCIENCE

In Explaining Creativity: The Science of Human Innovation (2012) Professor Keith Sawyer, one of the world's foremost scientific experts on creativity, summarizes, situates and

integrates the broad fields of creativity research during the last decades. His work regarding the Creative Process in chapters 5, 6 and 7 of this book, will be used to contextualise the creative practice research data - journal reflections and interviews - in the relevant literature.

Also of relevance to this research project, is Oshin Vartanian's assertion in Neuroscience of Creativity (2016) that evidence gleaned from research into the structure and function of the brain can foster creativity (2016, 257). He contends that "interventions designed to enhance motivation, abilities and skills must be realized in the brain and therefore have traceable neural correlates", a case-in-point being the ability to train working memory, which is hypothesized to play a pivotal role in creativity (2016, 258). Vartanian outlines the research around the notion that "one of the most common engines for the generation of creative ideas is the novel and useful combination of concepts previously thought to be unrelated" and proposes that this is a fruitful area for ongoing research (2016, 258-261).

This project addresses this ongoing research and seeks to assist screenwriters to develop strategies to enhance their creative thought and process by understanding how the creative process works at a neuroscientific level. Ultimately it seeks to illuminate how screenwriters may consciously activate the neural pathways and connections central to creativity, via their understanding of how modes of thinking "are accompanied by different activity patterns in the brain" (Fink & Benedek in Vartanian et al. 2016, 208).

— CONCLUSIONS

Based on an investigation of the processes of screenwriting as creative practice, this paper will interrogate creativity across domains to contribute to the developing field of creativity and screenwriting research. It will investigate how the screenwriter may draw upon knowledge of creativity and craft and deploy creativity and neuroscientific factors including: motivation, problem solving, metaphorical thinking, working memory and a tolerance for ambiguity, to work through obscurity and mystery to create clarity and focus during screenwriting.

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Session 11

Creativity predicts standardized tests above and beyond gpa

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Summary

Keywords-component: Creativity and development, Creative education methods

I. INTRODUCTION

It is expected that this study will contribute to the field of knowledge regarding the relationship between creativity and academic achievement. By incorporating both verbal-based and mathematically-based creativity tasks and regular classroom testing practices (as measured by student Grade Point Average – GPA and standardised testing (National Assessment Program Literacy and Numeracy - NAPLAN), recommendations for creativity-based practices are proposed to support children's academic development.

II. THE ROLE OF CREATIVITY IN SCHOOL GRADES

The purpose of this research is to analyse how much creativity and creativity-related constructs account for variance in the NAPLAN above and beyond grade point average (Total N = 1048). Students range from 9 to 18 years old (MEAN age = 14.3).

The relationship between students' creative ability and academic results have been investigated for many decades (Cicirelli, 1965; Getzels & Jackson, 1962; Gralewski & Karwowski, 2012). However, numerous empirical studies demonstrate often inconsistent and ambiguous findings.

Gajda, Karwowski, & Beghetto (2017) meta analysis highlights that past research has measured creativity or school grades using a wide array of methods, thus making it difficult to generalise findings. For instance, some research uses GPA or standardised testing as a measure of academic achievement and yet both differ in how they affect students. Nonethless, there are inconsistencies across year levels, countries and the degree of importance placed on such results (Gajda et al., 2017). In our study we utilised a literacy-based and mathematically-based creativity task that also aligned with Australian curriculum requirements. Whilst research has been conducted on student creative ability and subsequent academic achievement, our study will be exploratory in that it will test NAPLAN and GPA whilst examining student self rated beliefs about creativity. Additionally, this study will independently judge and assign scores on creative tasks across a two year period and will engage a wide range of students. Hence, this study provides a holistic approach to all aspects of academic grading within the Australian education system and will examine multiple aspects of creativity.

III. THE STUDY

Australian students participate in NAPLAN in Years 3, 5, 7 and 9 to test Literacy and Mathematical ability (ACARA, 2016). NAPLAN is considered high stakes testing as assessment data is used by government and policy makers to make decisions about Australia's education system (Polesel, Rice, & Dulfer, 2014). At a pedagogical level, NAPLAN data is used by schools and educators to diversify curriculum to support individual student needs and requirements. NAPLAN is considered a standardised test as all test-takers are required to answer identical questions in the same manner, to ensure that accurate comparisons between individuals can be made (Roehl, 2015). Our study includes NAPLAN results from students in Year 7 or 9. The GPA of students is recorded across all year levels. This sample includes GPA scores from students in Years 6 through to 12. The GPA results recorded consist of a Mathematics-only, English-only and overall GPA score for each individual student in both 2016 and 2018.

The literacy-based creativity task was designed as a photo caption task (e.g., Kaufman, Baer, Cropley, Reiter-Palmon, & Sinnett, 2013; Kaufman, Lee, Baer, & Lee, 2007). Students were presented with a photo and asked to write a caption. Judges with sufficient expertise, following the Consensual Assessment Technique (Amabile, 1996), then independently rated the creativity of each caption. Students also completed a mathematics equation creation task that was evaluated in the same manner. In 2016, each creativity task was conducted four times i.e. once a term. To minimize risk of boredom, whenever a student's creativity was recorded, the task was presented with a new caption or new mathematical equation. The same task was presented to students again in 2018. Hence,

each student engaged in different variations of the same task five times over the 2-year period.

We also included a range of other measures, including similarly repeated divergent thinking tasks scored for fluency, flexibility, and originality; the Big Five Inventory-II (Soto & John, 2017), intellectual risk-taking, and the Kaufman Domains of Creativity Scale (Kaufman, 2012).

IV. CONCLUSIONS

A series of Linear Regressions and multi-level analyses were calculated for overall NAPLAN scores and then the Verbal and Math NAPLAN. GPA was entered first, then Personality, and then the creativity and creativity-related tasks and scales. The primary question was whether creativity could account for additional variance in the NAPLAN beyond that accounted for by GPA and personality

Our findings were that 23.4% of variance for the NAPLAN was explained by GPA, 5.6% by Personality, 2.2% by Age, but, most importantly in terms of creativity, 4.8% by Creativity (Intellectual Risk Taking, Flexibility, Rated Math Creativity).

There is strong evidence that personality is stable throughout the lifetime – but creativity can be developed. This has implications for school education.

In terms of Verbal NAPLAN scores, all variables accounted for 41.9% of variance: 35.6% GPA, 2.9% Personality, and 3.4% Creativity (Performance Self-Report, Flexibility)

In terms of the Math NAPLAN, notably less overall variance was predicted. Everything accounted for 11.7% of the Variance, 7.5%

NAPLAN, 2.4% Personality and 1.8% Creativity (Rated Math Creativity). This finding is worthy of more exploration, however the proportional importance of creativity above and beyond GPA and Personality is significant.

It is important to note that we measured rated products of verbal and math creativity as well as divergent thinking; these were not just self-report measures.

These findings have implications for school education. GPA, unsurprisingly, accounts for the bulk of the variance on the NAPLAN. Given that both are strong predictors of academic achievement and ability, this finding is expected. For all three NAPLAN scores, creativity accounted for a similar amount of variance as personality. Yet whereas personality is very often included in studies of academic achievement, it is much more uncommon to also analyze creativity. In addition, if we know that creativity accounts for variance, and that creative capabilities can be taught, there is an opportunity for educators to impact academic achievement by offering students training in creativity. It is planned to replicate this study in order to further test our hypotheses.

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Session 11

Achievement goal orientations for creativity

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Summary

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I.   INTRODUCTION

Motivation the force that lies behind every human action and therefore it is considered to be essential for creating especially in education. The main body of research related to motivation in the area of creativity has been contextualized within the intrinsic/extrinsic motivation construct. Hennessey (2010) in a review of the studies related to motivation for creativity concluded that compelling evidence of more than 30 years of investigations supports that intrinsic motivation is conducive to creativity, while environmental constraints, including expected reward, expected evaluation, and competition, can be powerful killers of intrinsic task motivation and creativity performance. Nevertheless, in some cases, individual perceptions of extrinsic rewards and evaluations, and affective state of the person may operate synergistically along with intrinsic motivation as enhancers of creative production.

Much less attention has been paid in examining creativity with regards to the achievement goal construct which has been dominant in motivational research in the past four decades. Achievement goals is one of the key concepts in the motivational approach of social cognitive theory and refer to what people are constantly trying to attain (Schunk & Usher, 2012). Early research in the area demonstrated a basic distinction in achievement goal orientation: (a) learning or mastery goals which are adopted for the purpose of personal development and growth that guides achievement-related behavior and task-engagement, and (b) performance goal orientation adopted by individuals aiming at demonstrating competence. Students who adopt performance goals often to display maladaptive behaviors especially after failure such as "helplessness", negative affect attributions to low ability and deterioration in performance, while those with mastery-oriented goals did not focus on failure attributions; instead, they exhibited solution-oriented self-instructions, as well as sustained or increased positive affect and sustained or improved performance. (Elliott & Dweck, 1988). In the years of research the achievement goals have been repeatedly restructured adding a valence (approach/avoidance) description to orientation. The present study is based on the elaboration of the goal construct by Grant and Dweck (2003) where the performance goal has been divided into normative approach and avoidance (willing to perform better than others/not doing worse than others) ability approach and avoidance (willing to do better

than your previous performance/not do worse) and outcome approach and avoidance (willing to receive high grade/not to receive low grades).

The question on the relationships between the two frameworks namely which goal orientation instigates intrinsic motivation has also attracted research attention over the past decades. In general there has been a consensus that learning/mastery goals tend to be related to intrinsic motivation. Nevertheless the effect of performance goals on motivation and performance has provoked a debate: Some researchers have claimed that they lead to extrinsic and maladaptive motivation especially in school settings (Midgley, Kaplan, & Middleton, 2001) while others showed that performance avoidance orientation undermines intrinsic motivation but not performance approach goals (Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002).

In the area of creativity there is no systematic work related to the achievement goal construct. Some studies have examined goal orientation correlates with creativity in a variety of fields such as music or business management and classrooms goal structure. In general, they demonstrated that mastery goal orientations were related to higher creativity. Besides their useful results, these studies' primary focus was not the deep investigation of the achievement goals in relation to creativity but that was examined rather circumstantially.

This presentation includes two studies examining creativity in relation to achievement goal orientation among primary school students. The overall question they attempted to answer is what goal orientation is related to more creative works.

II. STUDY I

In the first study 124 primary school children aged between ten and eleven years old were randomly divided into five groups. Each group was instructed to adopt different goal orientations based on the Grant and Dweck (2003) paper. In line with studies with similar design (Sideridis, Kaplan, Papadopoulos, & Anastasiadis, 2014) in addition to the test directions further instructions aimed at instigating mastery goals, normative-performance-approach goals, normative-performance-avoidance goals, outcome-performance-approach goals and outcome-performance-avoidance goals. The ability performance goal was not included because participants did not have any previous indication of their creative ability as a basis for improvement. The additional instructions were adapted for creativity.

All five groups were asked to complete two graphic-artistic creativity tasks taken from the Evaluation of Creative Potential test (EPoC) (Lubart, Besançon, & Barbot, 2012). The first one was a divergent thinking task where a abstract stimulus was presented to students and asked to create as many drawing they could from it. The score on this task was determined by the number of drawings produced by each student. The second was a convergent thinking task where eight abstract stimuli were given to students and they were asked to combine at least four and create an original drawing. According to the scoring directions of the test an one to seven score was given to each student by taking account the novelty of the produced drawing as well as the level of integration of the given stimuli. The directions of the test were read to students followed by the instruction for instigating the desired goal orientations. For instance for learning goals the first group received the following instructions for the divergent thinking task: "Your goal is to try and understand how you can produce many original ideas. We would like you to try to understand and enjoy the process of coming up with many original ideas". Similar were the instructions for the convergent thinking task: "Your goal is

to try and understand how you can combine these forms into an original drawing. We would like you to try to understand and enjoy the process combining these forms into original ideas".

The results showed no significant interaction between groups and performance in divergent and convergent thinking as examined by the aforementioned EPoC tasks.

III. Study II

The second study included 219 primary school children with a mean age of 10.56 years. They were initially given the same tasks described above and afterwards they were asked to complete a questionnaire stating the type of goal orientation they had adopted without having received any instructions.

The results demonstrated firstly that the majority of the participating students (42%) stated that they adopted normative performance approach goals followed by mastery goals (24.8%), outcome performance approach (19.6%), normative performance avoidance (8.2%) and outcome performance avoidance (6.8%). Overall, three quarters of the sample stated that they adopted a performance goal.

Secondly, a significant interaction was observed between the goal orientations stated by students and their performance in the sum of divergent and convergent thinking scores ($F_{124,4} = 188.93$, $p < .001$). The highest scores were obtained by students who adopted normative-performance-approach goals ($M = 10.31$, $SD = 1.21$), followed by outcome-performance-approach ($M = 9.19$, $SD = .91$), normative-performance-avoidance ($M = 6.87$, $SD = 1.06$) and outcome-performance-avoidance ($M = 6.61$, $SD = 1.19$), while students who adopted master goals were the ones with the lowest scores ($M = 5.14$, $SD = 1.21$).

IV. Conclusions

This first attempt to investigate the achievement goal construct in relation to creativity appears to be raising more questions than providing answers. Some of the questions that need to be discussed are:

In the first study, why the learning goal orientation group did not demonstrate a higher performance as it has repeatedly been shown in the literature in other cognitive tasks? Is it due to flaws in research design and execution or is it because creativity is a completely disparate cognitive function than the cognitive tasks examined in previous research?

In the second study, why most students adopted a performance goal when engaged in creativity tasks? Is it because the wording of the test that asks them to think of ideas than other students encourages adoption of performance goals? Is the sense of "novelty" or "originality" competitive by nature, since, in order to be original you need to compare yourself with the others and be better than them?

These studies may stimulate research in this area which can provide very useful information for helping students develop creativity.

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