Education-based Situated Creativity

Renata Geld, Alan Jović, Diana Tomić, Dario Bojanjac, Ivana Hromatko, Ana Sović Kržić, Mirjana Tonković, Matija Jelača

As implied by many and explicitly stated by Florida (2002), „human creativity is the ultimate economic resource.“ However, just like human knowledge, which is one of the preconditions for creativity to occur, creativity does not happen out of thin air. It has its foundations, triggers and constituents. The aim of this conceptual paper is to discuss two constructs, *conceptual integration* and *emergent innovation,* and relate them to a newly proposed construct: education-based situated creativity. The construct is an extension from situated creativity, which has its practical side and presupposes strong interaction with the environment (Nonaka and Zhu, 2012). By adding “education” in the equation we focus on the necessity of perceiving creativity as a fundamental constituent of any educational process, and its systematic honing enabled through interdisciplinary inquiry. This enabling power of interdisciplinarity is, by its very nature, intimately related to *conceptual integration* and *emergent innovation.* The former is a cognitive mechanism believed to be responsible for human creative spark (Fauconnier and Turner 2002, Turner 2014) that probably developed at the time when our working memory could simultaneously juggle two elements that are different or seemingly unrelatable (e.g. think of William Kamkwamba’s wind turbine made out of bike parts and materials from a scrapyard, or the invention of the axle that combines a rod and wheels). *Emergent innovation* refers to a new approach to innovative thinking that relies on proactive re-shaping of the environment rather than simply reacting to changes. We complete our discussion by exemplify the approach by briefly outlining the process of creating a new standard of occupation and its corresponding qualification (Applied Cognitive Scientist) that is oriented towards creative economy and innovation in general, especially various aspects of R&D, while being anchored in the hexagon of interdisciplinary study of human mind known as cognitive science.

situated creativity, conceptual integration, emergent innovation, interdisciplinarity, cognitive science

Introduction

Our first association with creativity is usually tied to artists and creative individuals coming from specific walks of life and producing original ideas and artifacts that combine elements we have never seen or heard before. However, if we consider the totality of human creative endeavors and the circumstances in which they are coming to life, we may conclude that there are three fundamental factors/circumstances underlying the inception of creative processes:

a) crises of various extents that threaten or endanger the fulfillment of basic human needs;
b) creation as an occupational process (problem-solvers, innovators and creators – from scientists to artists);
c) the human need to engage in creation for various personal and/or "therapeutical" reasons (from free-time activities to healing).

The three categories frequently overlap, and they are in no way discrete or clearly delineated. Likewise, there is significant fuzziness within categories. Psychologists, for example, have grappled for decades with the question of whether creativity is domain-general, domain-specific, or both (Baer, 1994, 1998; Barab & Plucker, 2002; Brown, 1989; Cramond, 1994; Csikszentmihalyi, 1999; Diakidoy & Spanoudis, 2002; Gardner 1993; Han & Marvin 2002; Kaufman & Baer, 2002; Lim & Plucker, 2001; Plucker, 1998, 1999; Sternberg, 2002).

Even though our discussion on creativity and innovation is primarily concerned with circumstances described under b), it is important to mention that in our communication with professionals responsible for carrying out innovation-related developments in their business environment, those perceived as creative emphasized the importance of their experience, activities, and interests outside of workplace when coming up with novel ideas. They also addressed the importance of knowledge obtained from others – within or outside their place of work. In other words, their inspiration for novelty is frequently linked to elements outside their narrow field of expertise. The latter leads us to one of the central notions we discuss in this paper – the notion of conceptual integration as a mental operation underlying creativity (Fauconnier and Turner, 2002; Turner, 2014). As we shall demonstrate later, the nature of the construct implies integration of seemingly opposite or unrelated elements, ideas, notions, and domains of knowledge. This, in turn, implies that an important way to foster creative processes in the workplace is building interdisciplinarity and collaboration in the workplace and fostering them in education.

The second element we are proposing as fundamental to the discussion of creativity, or specifically *education-based situated creativity*, is the process of *emergent innovation* (Peschl & Fundneider, 2008, 2013; Peschl, 2019). In discussing innovation and the creation of novel knowledge, Peschl re-examines forms of "together" and "-co": being/working together and collaborating with others (socio-epistemic dimension); being together and interacting with the material world (co-becoming dimension); and being together and co-developing with the future as "learning from the future emerges" (2019, p.4). What this means is that innovation is about changing the environment in a future-oriented manner. It is not enough to react to change, we need to be proactive by "influencing and shaping the environment in such a way that novelty may arise in the future" (p. 6).

Finally, we relate the two processes to the idea of situated creativity (Nonaka, I., & Zhu, Z. 2012). We rely on this idea because we acknowledge that creativity has a practical side that involves both human cognitive capacities and useful applications of ideas. Stemming from Confucian creativity that assumes flexibility and open-mindedness to contextual factors and the environment, and insists on imagination and moral sensibility, the concept of situated creativity extends organically to education. Creative solutions and ideas emerge through students' interactions with their teachers and with each other, as well as through their interaction with the environment and communities to which they belong during their education and later in the labor market.

In the following sections, we describe and discuss the two above-mentioned constructs that underlie our approach to creative processes leading to innovation. We complete our discussion by exemplifying basic constituents of the constructs pertaining to our own collaborative/creative process that resulted in a new standard of occupation and the accompanying standard of qualification. The skills and competencies of the two standards pertain to a collaborative and interdisciplinary working environment that bridges the gap between scientific/scholarly work and the industry (for more on the types and significance of standards see ESCO: European Skills/Competences, qualifications and Occupations). Our ultimate aim was to design a new university program in cognitive science that responds to the needs of a fast-changing environment characterized by "VUCA" (volatility, uncertainty, complexity, and ambiguity) (Peschl, 2019). The collaboration was an integral part of a project co-funded by the European Social Fund and carried out by the Faculty of Humanities and Social Sciences, University of Zagreb.

2. Conceptual integration

Language is rightly regarded as one of the most sophisticated products of the human creative mind. Complex meanings are created with incredible ease and linguistic novelties are literally everyday phenomena. Language is used to create puns, catchy headlines, memes, and jokes. However, in addition to this intentional wordplay and word combinatorics, there is a much greater portion of meaning construction and thought that happens without any conscious effort. Let us consider the example in Figure 1. The authors illustrate conceptual integration and meaning construction by analyzing a nominal compound. The central question the authors address is how we get from linguistic units to conceptual elements and vice versa. It is obvious that the compound ("land yacht") names two conceptual elements in two different mental spaces. The hearer/understander is directed to construct the rest. "Land" and "yacht" come from different domains – land as opposed to water. What the understander does is perform mappings between these two spaces: the yacht corresponds to the luxury car, the land to the water, the driver to the skipper, the road to the course and the owner to the tycoon. The conceptual integration of mental spaces depends on building an analogical mapping. However, the outcome of the integration (*land yacht*) is not based on individual mappings of predictable counterparts. "Land" and "yacht" belong to two different domains and resulting mental spaces, but they are not conceptual counterparts. The meaning of the compound relies on the *emergent structure* that results from the blend of the two spaces.

It is this kind of construction of meaning that makes humans human and the human mind mysteriously complex. We run conceptual blends all the time, and most of the time without cognitive effort. We combine elements that have probably never been combined before, and selectively project from one mental space to another. In fact, human uniqueness is tied

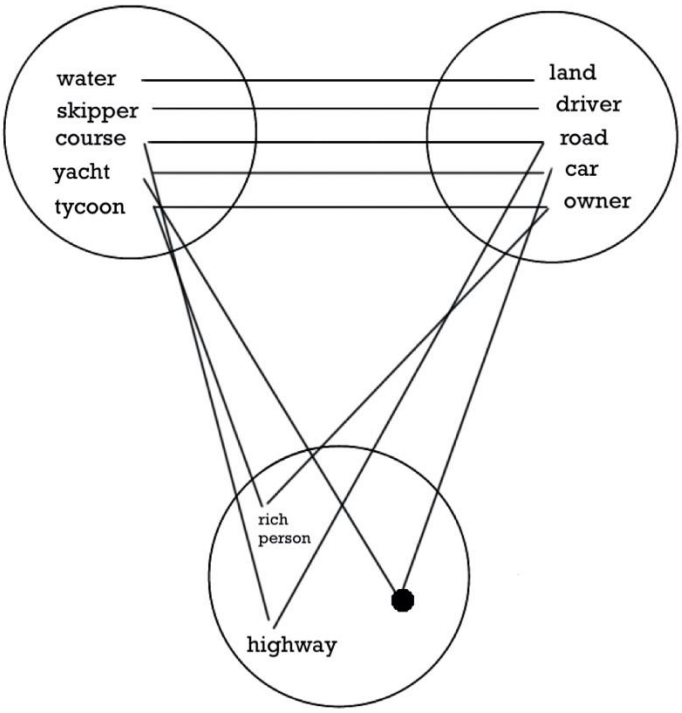

Figure 1. Land yacht – 'large, luxurious automobile' (taken from Fauconnier and Turner, 2002, p. 357)

to our ability to make more than a simple perceptual binding to see the whole. In other words, we have evolved to the point where we are able to integrate two completely different inputs to create novel emergent structures (see also Koestler, 1964; Mithen, 1996). This point in evolution is believed to be the birth of *creative thought.* Once we were able to hold two distant, different, or opposing elements in our working memory and juggle their substance to form a new meaning, we were ready for creative deeds. However, as we have already seen in the case of "land yacht", the juggling of this kind does not reduce to a manipulation of forms. The two elements carry their conceptual weight and the meaning produced is the result of what Fauconnier and Turner call the *mind's three I's* (2002, p.7). The first *I* stands for *Identity*. The juxtaposition of sameness and oppositeness has been widely taken for granted in various human disciplines and creative domains – from mathematics and physics to the arts, music, and social sciences. However, the recognition of identity is actually a tremendously complex and imaginative work that we do most of the time without bringing it into our conscious thought. The second '*I*' is *Integration.* Recognition of identities and opposites is an integral part of conceptual integration, which has both elaborate structural properties and operational constraints. The third *'I'* stands for

Imagination. Our imagination is constantly at work, and our consciousness is far from comprehending its activities. We imagine hypothetical situations, create fictional characters, pretend, simulate all sorts of activities, irrespective of the presence of external stimuli.

Now, let us go back to the manipulation of form. For example, why is translation so difficult? Because we do not translate words/forms, but strive to translate meanings, or, more precisely, approximate and construct meaning in one language based on the meaning in another. If translation were about manipulating and substituting forms from one system into another, translation software would do its work impeccably. However, the reality is quite different, and the reason is more than obvious: language is packed with semantic nuances, polysemy, emergent meanings based on irony and humor, idiosyncrasies, idiomatic expressions, metaphors, and so on. Furthermore, language cannot be separated from the rest of cognition. It codes changes in perspective, attention, and a number of other cognitive processes. Still, the efficacy of form and its transformation and manipulation is striking and cannot be neglected. Fauconnier and Tuner (2002, p. 4) stress:

> *A college student enrolled in economics, once a branch of ethics, will now spend considerable time manipulating formulas. If she studies language, once firmly the province of humanists and philologists, she will learn formal algorithms. If she hopes to become a psychologist, she must become adept at constructing computational models. The manipulation of form is so powerful and useful that school is now seen as largely a matter of learning how to do such manipulation.*

In short, our imagination coexists with the mind's efficacy to manipulate form, and this coexistence is necessary and welcome. For example, we can manipulate linguistic forms and change an active sentence into a passive one. The transformation is relatively straightforward and governed by the syntactic rules of the language we are using. However, the two sentences do not mean the same. They code different perspectives taken on the event that the perceiver/speaker wishes to describe. In other words, the perspective taken plays the role in meaning construction. In fact, the most impressive and intricate structures and forms, such as those constituting language, mathematics, art, or music, emerge through the ability of humans to construct meaning. The construction of meaning is pervasive and it does not cease. Human beings are constantly making sense of whatever they receive through the sensory system. Naturally, this process is largely subconscious, even though we sometimes intentionally "unpack" meanings for various reasons when we teach, research, explain, describe, etc. Imagine a group of children sitting on the steps leading to the sea, as in Figure 2. Until they are told that they are sitting on top of the sea organs, they perceive their surroundings without consciously attending to any of its elements. Once they learn that the steps hide the tubes that produce music when hit by the sea waves, they start observing and assign meaning to the form that surrounds them. This takes us to our second example of conceptual integration and the emergent meaning it produces. The children sitting on the steps are unpacking the constituents of the Sea Organs in Zadar. They can hear the music produced by this huge musical instrument, witness the interplay of water and land, and participate by enjoying the atmosphere and assigning meaning to what is taking place around them. This is probably what Nikola Bašić, the architect, wanted to achieve when he was chosen to transform this important part of Zadar. He has stressed more than once that his aim

was a metaphorical place that shapes the mental image of the town.[1] The place is inviting visitors, both locals and tourists, to interact with their environment. This interaction, however, is not a predictable ritual of drinking coffee or wine in crowded cafes and restaurants that usually adorn the promenades in tourist resorts and coastal towns. Rather, Zadar's linear promenade leads to a place that has reconceptualized one of the most beloved pastimes – observing the billows and calms of the sea.

Figure 2. "Unpacking" of the Sea Organs

The process of conceptual integration that we have just exemplified was recognized and described by cognitive scientists in the early 1990s and has since been studied in various fields and disciplines: linguistics, music theory, social sciences, literary studies, multimodal communication, cognitive neuroscience, film studies, mathematics, contemporary art, etc. (see e.g. Antović, 2018; Cook, 2010; Gómez-Ramírez, 2020; Gordejuela, 2021; Hiraga, 1999; Lakoff & Núñez, 1997; Maldonado, 1999; Poulsen, 2019; Sondergaard, 1999; Thagard & Stewart, 2011; Turner, 2001). This conceptual operation is as responsible for simple mental events as it is for the most complex human creations. Likewise, sometimes the process happens instantaneously and sometimes it takes literally centuries of evolution of thought. As noted by Facuonnier and Turner in discussing the mathematical domain of complex numbers, this well-structured blend was fully accepted in the 19th century (2002, p. 25). Even though various parts of the system had appeared several centuries earlier, they simply did not fit into the mathematical conceptual system of the time when its first ideas had been conceived.

This capacity to integrate different domains of knowledge, such as knowledge of architecture and music in the case of the Sea Organs or knowledge of numbers and vectors in

[1] See for example eZadar.hr*: https://ezadar.net.hr/ostalo/intervjui/2593685/nikola-basic-morske-orgulje-i-pozdrav-suncu-poticaj-su-svojevrsnom-urbanom-hedonizmu/*

their two-dimensional space in the case of complex numbers, is closely related to the other central construct we would like to highlight as crucial in the context of education-based situated creativity: *emergent innovation.* In the following section, we briefly discuss its nature and relevance to the conceptual framework we discuss in this work.

3. Emergent innovation, education for innovation, and new literacies

According to Peschl, innovation is "*about future states of the environment and about changing it in a future-oriented manner"* (2019, p. 6). This view is a step forward (or away) from traditional approaches to innovation, as it assumes that, in order to create conditions for novelty to arise, we need to proactively influence and shape the environment, rather than just reacting to change as it occurs. As mentioned in the introduction, Peschl examines three forms of "together" and "-co": being/working together and collaborating with others (socio-epistemic dimension); being together and interacting with the material world (co-becoming dimension); and being together and co-developing with the future as "learning from the future emerges".

Let us first briefly explain what is meant by a rather paradoxical tenet of this approach, namely "learning from the future". If we belong to the category of creative individuals whose job description implies innovative thinking, we tend to approach the process in one of the following ways: either we look to the past and try to extrapolate what worked well as a solution at a certain point in time, usually coming up with relatively unimaginative solutions, or we engage in a kind of back-and-forth process of trial and error, widely known as design thinking, which results in more or less optimized solutions. However, learning from the future, as proposed by Peschl and several other authors (Baregheh et al., 2009; Fagerberg et al., 2006; Peschl and Fundneider, 2008; Peschl, 2019) is a socio-epistemological process that consists of both knowledge processes and social practices. It assumes proactivity in shaping and influencing the environment that becomes conducive to novelty. In other words, innovation follows transformation in mindsets and attitudes that needs to start on both the individual and organizational levels. Naturally, this kind of transformation requires collaboration and different forms of "together". The first form refers to collaboration between innovators, users and stakeholders. The creative process is thus infused with diverse perspectives, which is a necessary precondition for creative work and innovative thinking. In the following sections, we shall address this aspect of collaboration by tackling *interdisciplinarity*, which on the one hand depends on *conceptual integration* and on the other hand is the driving force of *emergent innovation*.

From what has been said so far, it is self-evident that a creative and innovative mindset should be harbored and developed. Such mindsets do not come out of thin air. However, a large number of scholars and educationalists maintain that young people's curiosity and creativity decline as they progress through their formal education[2]. The older they get, the less creative they become. By the time they start high school, they have learned how to navigate large quantities of facts, which proves very useful during their university education. Creative processes become an exception rather than a rule. An effective way to fight this is introducing meaningful communication across all school subjects, a multi-perspective dialogue in which knowledge is

[2] See for example Robinson and Aronica (2009), Sharan and Chin Tan (2008), Sternberg (2006).

created and recreated. The dialogue continues through interdisciplinary university programs that are designed to address complex topics and develop a mindset necessary for innovative thinking in the workplace. Once we have achieved this kind of continuation, it may be easier to rethink other important forms of "together", namely those between the innovator and the material, and the world in which the process is situated. Traditionally speaking, a creative agent has an idea, a concept, or a form, and he/she shapes the environment according to that form (Peschl, 2019). In other words, the material/environment passively obtains its form. However, as proposed by Ingold (2013, 2014, cited in Peschl, 2019), we can try to rethink these relationships by considering the dynamics of the innovator and the material/environment as a flux of activities that come together in the process of design or innovation. Both sides are active and passive, shaping and changing each other. Naturally, this kind of mutual engagement requires high levels of observational power and openness to novel qualities that may emerge on both sides. In other words, it may be very difficult to either achieve or recognize the potential of this unity if the innovator's mind were not accustomed to interaction and change. And this is exactly what needs to be nurtured in education. If we want to raise innovators who are proactive and appreciative of their environment, it is crucial to situate our students' bodies and minds in an educational setting that provides conditions for interdisciplinarity, attentiveness and collaboration. In this way, we preserve, rather than break, the thread of natural curiosity and creativity found in children and their innate need to interact with the environment. A few lines above, we intentionally wrote "our students' bodies and minds" thinking of another important cognitive scientist, Andy Clark, who argues quite convincingly that human thought and reason are not activities that occur only in the brain, not even only in our body. As we build our physical and social world, we simultaneously build and reconfigure our minds and our capacity to think and reason. In short, our minds are expanded and "cognition leaks out into body and world" (2008, p. xxxviii).

3.1. New literacies and personal transformation

Clearly, creative individuals need to be cultivated and nurtured. Likewise, creative endeavors require personal transformation. The innovator needs to "fully engage and co-develop with his or her material or artifact in a process of co-becoming" (Peschl, 2019, p. 11). Another important requirement is learning to give up control and let go. This creates space for options and new ideas that would otherwise stay hidden. Stressing the importance of relinquishing control and going with the flow rather than steering the process toward a fixed, preconceived idea, Peschl (2019, p. 12) suggests the following forward-looking (epistemic) skills, practices and mindsets: openness and receptivity, the ability to embrace the unexpected, the ability to wait and be patient, the ability to engage and fully immerse oneself into one's environment, the ability to develop a sense of potential and what is "not yet", the ability to listen to what "wants to emerge" and what "wants to come into being", the ability to recognize and appreciate details and "weak signals", the ability to orientate oneself toward emerging purpose rather than sporting a mind-set of optimizing existing functionalities. Let us exemplify this by our own transformation as a team working on a highly interdisciplinary program design. The team consisted of eight members from disciplines belonging to the hexagon of cognitive science (CogSci) (see Figure 3). The aim was to communicate across disciplines in order to design a study program that would

meet the demands of a fast-changing environment characterized by VUCA. Although we were guided to some extent by the existing CogSci programs, our work had two distinctive starting

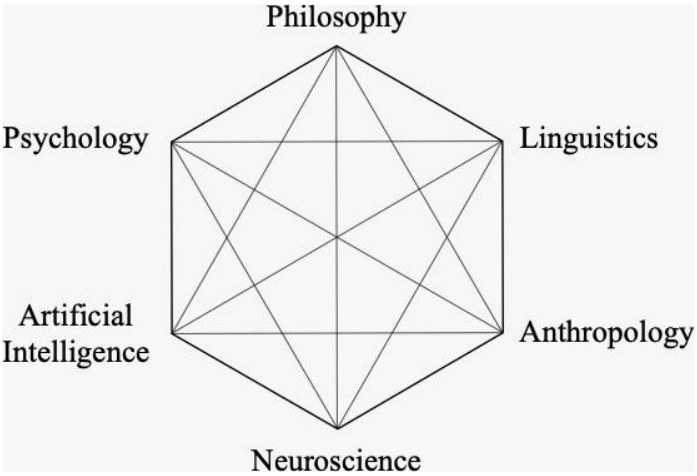

Figure 3. Hexagon of cognitive science

points: a) the methodology of the project that required development of the two standards (occupation and qualification) prior to the program, and b) a general idea that the program needs to develop skills and competences pertaining to innovative thinking. The former already required tweaks in our mindsets, because the standard of occupation needed to be created in a close interaction with employers. The standard also required the proposer to project the significance of the occupation for the future. As for the skills and competencies pertaining to innovation, the basic elements we had initially operated with were the constructs extensively discussed by psychologists and cognitive scientists: creativity and conceptual integration, respectively.

We spent months trying to move away from our individual disciplines and find ways to identify employers who were both relevant to the content we were trying to develop and willing to share their thoughts. First, we looked at the employment figures and careers of CogSci graduates abroad. After we had identified who their employers were, we looked for similar companies in Croatia. We selected successful and award-winning employers of various sizes and talked to those employees whose job descriptions included innovation, research and development, project management, and alike. Over a period of several months, we gathered valuable insights from team leaders, project managers, innovation consultants, startup scouts, software designers and architects, educators in various fields, experts in marketing and digital communications, educational technologies, cybersecurity, research and development, and HR experts. The process was lengthy and taught us patience and the need for receptivity. We gradually learned to interpret the “weak signals” and allowed ourselves to be open for the unexpected. Probably the most valuable turn in our minds happened when we realized that we ourselves are inventors who must realize the potential of the program we are about to design. We had the hexagon of disciplines as our material, future graduates as users, and employers as key stakeholders. And we were all immersed in our environment, trying to discover the essence of what a CogSci graduate will contribute to his/her workplace. At that point, we acknowledged the

importance of *emergent innovation* that focuses on identifying the *purpose* and *potential* of what is at the heart of the innovative effort. At some point in the middle of the process, the outlines of the *potential* emerged and we were able to articulate that the primary *purpose* of our graduates' target occupation (and qualification) is to bridge the gap between scientific/scholarly work and industry. They will be mediators who understand the applied potential of cognitive science, who will be able to communicate across disciplines, create cohesion and a collaborative atmosphere in interdisciplinary teams, and find ways to strengthen innovative resources within their companies/teams.

The entire process had been a journey into a relatively unexplored territory. Our team of innovators/scientists was heterogeneous, the subject matter only partially familiar due to its complex interdisciplinary nature, and we were not entirely accustomed to communication with the industry. However, we allowed ourselves to wander and deviate from the course, which turned out to be a very productive approach leading to novelty.

4. Conclusion

The aim of this paper was to relate and contextualize two constructs that are discussed by cognitive scientists, but have not yet been brought together in scientific research or practice: a) *conceptual integration*, which is deemed responsible for emergent meaning and creative thinking, and b) *emergent innovation*, an approach to innovation that is believed to have a considerable transformative potential in all areas of life, from education and science to industry.

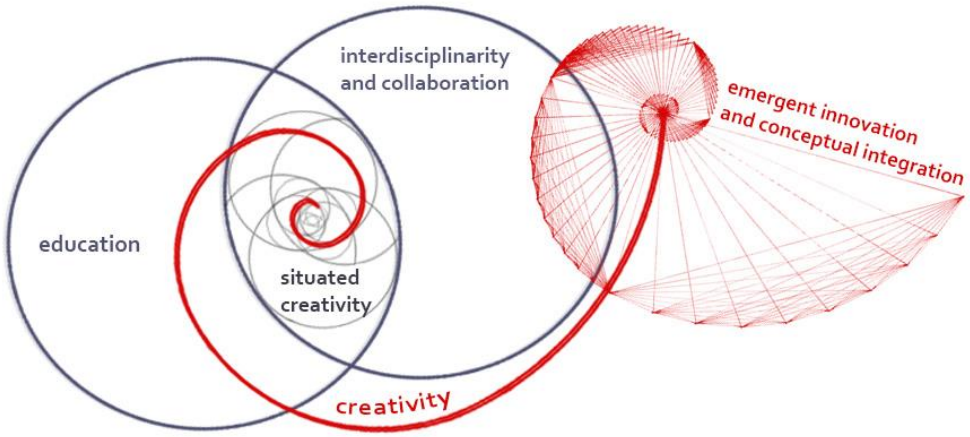

Figure 4. The ecosystem of education-based situated creativity

The two constructs were used to outline the essence of what we named *education-based situated creativity* – the kind of creativity that is nurtured through education and shares certain traits with the existing concept of situated creativity: close interaction with the environment, flexibility and open-mindedness to contextual factors, and focus on the practical side of creativity that includes both human cognitive capacities and the useful application of the idea. The model in Figure 4. shows the ecosystem of the constructs discussed and their core constituents that communicate and evolve.

Even though cognitive science itself has not been discussed here, it provides a framework that holds the content together: the constructs tackled in the paper are researched and discussed by cognitive scientists, the process of creative design undertaken by the authors was described as emergent innovation closely related to cognition, and the ultimate goal of the process that triggered our consideration of the constructs described above was the creation of a new and innovative university program in cognitive science.

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