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INNOVATIVENESS AND CREATIVITY AS NATURE AND NURTURE

Abstract. The paper describes the concept of innovativeness and creativity from the perspective of nature and nurture. There is the description of basic concepts influencing the innovativeness and creativity from the human nature and educational point of view.

Keywords: innovativeness, creativity, business psychology, nature, nurture

1. Introduction

Science is still conducting research on any connections which might be found between genetics and creativity. Psychology has found a possible connection between genetic factors and above average creativity. An increased amount of the neurotransmitter serotonin increases the connectivity in the brain's posterior cingulate cortex. The posterior cingulate cortex helps in awareness and the internal thought processes common in creativity¹ Increased serotonin levels are a key factor in those who suffered from neuropsychiatric disorders, such as bipolar disorder, autism and schizophrenia². These disorders are all known to have a genetic component to them. We can see these disorders being passed down through generations with

¹ Karlsson R., Graae L., Lekman M., Wang D., Favis R., Axelsson T., Galter D., Belin A.C., Paddock S.: MAG11 Copy Number Variation in Bipolar Affective Disorder and Schizophrenia. "Biological Psychiatry", Vol.71, No. 10, 2012, p. 922-30, PMID: 22381734; Kraus C., Ganger S., Losak J., Hahn A., Savli M., Kranz G., Baldinger P., Windischberger C., Kasper S., Lanzenberger R.: Gray Matter and Intrinsic Network Changes in the Posterior Cingulate Cortex after Selective Serotonin Reuptake Inhibitor Intake. "NeuroImage", Vol. 84, 2014, p. 236-244, DOI: 10.1016/j.neuroimage.2013.08.036.

² Kyaga S., Lichtenstein P., Boman M., Hultman C., Langstrom N., Landen M.: Creativity and Mental Disorder: Family Study of 300 000 People with Severe Mental Disorder. "The British Journal of Psychiatry", Vol. 199, No. 5, 2011, p. 373-379, DOI: 10.1192/bjp.bp.110.085316.

a higher probability of developing the disorder if it was already diagnosed in a close relative³. The disorder itself and the effect it has on the individual's thoughts and way of processing information can appear as creativity (taking a different outlook on the environment).

2. Innovativeness and Creativity from the Perspective of Nature

In other findings, the corpus callosum (the fibers that connect the two hemispheres of the brain), appears to be smaller in writers, artists and musicians. The conclusion is that a smaller corpus callosum forces both sides of the brain to work more independently of each other. This allows for a different way of thinking. This different way of thinking and tackling problems can be viewed as creative thinking. We can observe creativity in many children.

Children are uninhibited in their thoughts. Somewhere along the way, this creativity can disappear. There are genetic components which can create creativity. This creativity can transform into innovative thoughts⁴.

3. Innovativeness and Creativity from the Perspective of Nurture

Despite the genetic component to creativity, creativity still needs to be nurtured. Children can be taught to fight against their creativity in many ways. By not being allowed to use their creativity, children may lose the ability to think creatively.

³ Moore D., Bhadelia R., Billings R., Fulwiler C., Heilman K., Rood K., Gansler D.: Hemispheric Connectivity and the Visual-spatial Divergent-thinking Component of Creativity. "Brain and Cognition", Vol. 70, No. 3, 2009, p. 267-272, DOI: 10.1016/j.bandc.2009.02.011.

⁴ Ukkola-Vuoti L., Kanduri C., Oikkonen J., Buck G., Blancher C., Raijas P., Karma K., et al: Genome-wide copy number variation analysis in extended families and unrelated individuals characterized for musical aptitude and creativity in music. "PLoS One", Vol. 8, No.27, 2013.

This means that we must look at the education system. How is innovativeness, as an attribute, developed by the educational process and how is it fostered? The role of teachers and their methodology will be very important to the nurturing of creativity and therefore promoting innovativeness⁵ in future generations⁶.

There are the concepts of Big “C” Creativity and Little “c” Creativity⁷. The Big “C” Creativity (BCC) looks at creativity as being something specific to certain individuals, geniuses and prodigies. These individuals have a profound impact in society and are well known in their field and beyond, creating something entirely new. The Little “c” Creativity (LCC) defines individuals who have not reached that level of influence. These are individuals who will use their creativity to effectively solve smaller problems, that is, daily life problems that they might encounter. They are less well known. This is like Shneiderman⁸ who breaks creativity down into two similar categories, such as:

- Revolutionary equivalent to (BCC).
- Evolutionary equivalent to (LCC).

⁵ Knop L., Olko S.: Cooperation in clusters and networks – creativity and innovativeness challenges: an introduction. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 109, Gliwice 2017, s. 5-7; Pichlak M.: Innowacje ekologiczne jako źródło przewagi konkurencyjnej przedsiębiorstw. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 102, Gliwice 2017, s. 303-317; Przybylska E.: Potencjalne źródła innowacji w branży TSL. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 101, Gliwice 2017, s. 401-410; Olko S.: The impact of the networks and clusters in cultural and creative industries on regional innovation ecosystem – analysis of the selected cases in Europe. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 109, Gliwice 2017, s. 25-42; Osika G.: Innowacje społeczne jako wsparcie dla inteligentnych specjalizacji – uwarunkowania komunikacyjne. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 95, Gliwice 2016, s. 369-381; Kozubek R.: Innowacje społecznie odpowiedzialne a kompetencje miękkie pracowników przedsiębiorstwa. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 95, Gliwice 2016, s. 225-236; Pichlak M.: Innowacyjność nowych produktów – ujęcie wielowymiarowe. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 89, Gliwice 2016, s. 397-407; Michalak A.: Inteligentna specjalizacja jako koncepcja wdrażania polityki inteligentnego rozwoju. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 96, Gliwice 2016, s. 123-132; Kochmańska A.: Kompetencje miękkie w innowacyjnym przedsiębiorstwie. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 95, Gliwice 2016, s. 189-199; Szwajca D.: Macierz aspiracji innowacyjnych jako narzędzie zarządzania portfelem innowacji w przedsiębiorstwie. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 95, Gliwice 2016, s. 322-333; Dolińska-Weryńska D., Weryński P.: Percepcja innowacji wśród przedsiębiorców z sektora MŚP w województwie śląskim. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 95, Gliwice 2016, s. 103-117; Knop L., Brzóska J.: Rola innowacji w tworzeniu wartości przez modele biznesu. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 99, Gliwice 2016, s. 213-232; Jonek-Kowalska I.: The sources of risk in the process of implementing technological innovations, w: *Mezinárodní Masarykova konference pro doktorandy a mladé vědecké pracovníky. MMK 2011. Sborník Příspěvků, Hradec Králové, Česká Republika, 12-16.12.2011 (Dokument elektroniczny). Magnanimitas, Hradec Kralove 2011, s. 280-290; Jonek-Kowalska I.: Współdziałanie w formie aliansu strategicznego jako metoda wspierania działalności innowacyjnej. *Zeszyty Naukowe Politechniki Śląskiej, s. Organizacja i Zarządzanie*, z. 55, Gliwice 2011, s. 81-95.*

⁶ Expert Group Report. Innovation and Creativity in Education and Training in the EU Member States Fostering Creative Learning and Supporting Innovative Teaching, Rethinking Education, 2012.

⁷ Craft A., Jeffrey B., Leibling M.: Creativity in Education. Continuum, London 2001.

⁸ Shneiderman B.: Creating Creativity: User Interfaces for Supporting Innovation. “ACM Transactions on Computer-Human Interaction”, Vol. 7, No. 1, March 2000, sslltest.cs.umd.edu/ben/papers/Shneiderman2000_Creating.pdf, p. 5-6, DOA: 07.01.2017.

LCC is the type of creativity that we would most likely to be focusing on in an educational setting. BCC has an element of rarity. If we focus ourselves on LCC, we will also be able to influence and create instances of BCC.

LCC allows for the ability of creativity in all people. However, there is a higher capacity for creativity in early childhood⁹. This is the time that we must focus on fostering creativity. The development of creativity depends on if and how it is nurtured¹⁰. Creativity is often questioned as being something irrelevant to teaching, despite its positive benefits¹¹.

4. Innovativeness and Creativity as an Attribute Developed by the Educational Process

"to understand is to invent" – Piaget¹².

How do our current young students learn?

There has been a change in the way students are learning. In young children, we see much more use of electronic devices. This may be impacting young children's perceptions of knowledge intake.¹³ Young students are expecting school to be like the rest of their lives. But school education still does not reflect this. There has been a push at schools, such as Northampton Community College, to create "flipped classrooms" where homework is an online assignment. Students are expected to use the internet to watch videos, read and do other work prior to the class.

This contrasts with lecture and rote memorization simply for the test. Discussion and group interaction can create a deeper understanding of the material and allow for creativity to blossom with the learned knowledge¹⁴. It is generally accepted that creative individuals may have similar traits, but this does not mean creativity is completely nature-based¹⁵. Because the information is presented in a way that mirrors the way students learn and research other topics

⁹ Russ S.: Play and Creativity: Developmental Issues. "Scandinavian Journal of Educational Research", Vol. 47, No. 3, 2003, p. 291-303.

¹⁰ Esquivel G.B.: Teacher Behaviours that Foster Creativity. "Educational Psychology Review", Vol.7, No. 2, 1995, p. 185-202.

¹¹ West M.A., Richards T.: Innovation, [in:] Runco M.A., Pritzker S.R. (eds.): Encyclopedia of Creativity. Academic, San Diego, CA 1999, p. 45-56; Beghetto R.A.: Does Assessment Kill Student Creativity? "The Educational Forum", Vol. 69, 2005, p. 254-263.

¹² Piaget J.: To Understand Is to Invent: The Future of Education. Grossman Publishers, New York 1973.

¹³ Pedró F.: The new Millennium Learners: Challenging Our Views on ICT and Learning: OECD-CERI, 2006, <http://www.oecd.org/dataoecd/1/1/38358359.pdf>.

¹⁴ Craft A.: Creativity in Schools: Tensions and Dilemmas. Routledge, London 2005.

¹⁵ Simonton D.K.: History, Chemistry, Psychology, and Genius: An Intellectual Autobiography of Historiometry, [in:] Albert R.S., Runco M.A. (eds.): Theories of Creativity. Sage Publications, Newbury Park, London 1990, p. 92-115.

in their life, they may be able to pick up information more quickly. This frees up time in the classroom to be more creative and discuss the material with each other and the instructor¹⁶.

As we are defining creativity and innovation¹⁷, teachers must also define creativity for their students¹⁸. Creativity is sometimes used for projects and other parts of work within the classroom but it is rarely defined. This lack of definition may lead to confusion and miscommunication between teachers and students. Instead of a teacher writing in the instructions "use creativity", they should define creativity to allow for better understanding or instead of writing the comment on a paper, "creative use of [insert]", explain how the work was creative.

Defining creativity for students may require a few steps:

1. A deconstruction of several current myths about creativity which are leading to a shared misunderstanding of the issue¹⁹
2. A discussion and framing of the implications of "newness and value" in the educational context²⁰
3. An emphasis on the process instead of the product²¹
4. Implicit theories or myths about creativity.

There are two sides to creativity in early childhood:

- Children have less basic knowledge and by theory can be less creative.
- Children are uninhibited and can think more originally.

This simply means that we must adapt creativity to age and knowledge. This will allow for creativity across age ranges and knowledge levels. There are theories that creative can be viewed as a separate entity from knowledge acquisition²². Creativity is simply an expression. It can be used for educational purposes, but something not innately related to knowledge acquisition.

¹⁶ Craft A.Ł. *Creativity in Schools: Tensions and Dilemmas*. Routledge, London 2005; Simonton D.K.: *History, Chemistry, Psychology, and Genius: An Intellectual Autobiography of Historiometry*, [in:] Albert R.S., Runco M.A. (eds.): *Theories of Creativity*. Sage Publications, Newbury Park, London 1990, p. 92-115.

¹⁷ Olkiewicz M., Bober B., Wolniak R.: *Innowacje w przemyśle farmaceutycznym jako determinanta procesu kształtowania jakości życia*. „Przegląd Chemiczny”, nr 11, 2017, s. 2199-2201; Wolniak R.: *Analiza relacji pomiędzy wskaźnikiem innowacyjności a nasyceniem kraju certyfikatami ISO 9001, ISO 14001 oraz ISO/TS 16949*. „Kwartalnik Organizacja i Kierowanie”, nr 2, 2017, s. 139-150; Krzemień E., Wolniak R.: *Innowacyjność polskiej gospodarki na tle krajów Unii Europejskiej*. „Kwartalnik Organizacja i Zarządzanie”, nr 4, Gliwice 2016, s. 155-165; Wolniak R.: *Metody i narzędzia Lean Production i ich rola w kształtowaniu innowacji w przemyśle*, [w:] Knosala R. (red.): *Innowacje w zarządzaniu i inżynierii produkcji*. Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją, Opole 2013, s. 524-534.

¹⁸ Sharp C.: *Developing Young Children's Creativity: What Can We Learn from Research?* “Topic”, Vol. 32, 2004, p. 5-12.

¹⁹ Beghetto R.A.: *Does Assessment Kill Student Creativity?* “The Educational Forum”, Vol. 69, 2005, p. 254-263.

²⁰ Craft A.: *Creativity in Schools: Tensions and Dilemmas*. Routledge, London 2005.

²¹ Russ S.: *Play and Creativity: Developmental Issues*. “Scandinavian Journal of Educational Research”, Vol. 47, No. 3, 2003, p. 291-303.

²² Runco M.A.: *Education for Creative Potential*. “Scandinavian Journal of Educational Research”, Vol. 47, No. 3, 2003, p. 317-324.

Learning can be done in a creative way. Forming connections between pieces of information is an example of creative learning. Teachers can also teach from this perspective. Teaching by connecting pieces of information together from the class or other classes makes the information relevant and meaningful to the student. Active learning is a key piece of this puzzle²³. This makes students responsible for their own learning.

Creativity can also be killed when teachers have the mindset that the "answer is known before the question is posed"²⁴. This limits the students' creative thinking. If there is an answer, assuming there is a single correct answer, the student looks for that one answer. All other answers are automatically dismissed by the teacher²⁵. One study shows that teachers do prefer an average answer to a unique one. The emphasis teachers place on avoiding mistakes can also be a great hindrance to leaning and creativity.

Students may not be raising their hands to answer a question or participate in discussions because they are afraid of making a mistake. Risk-taking is always associated with creativity²⁶. It can be a paradoxical situation²⁷. Teachers prefer students who stay in line, but this will hinder the creativity that they hope to achieve²⁸. This desire for students to stay in line may be because it is easier for the teacher to keep track of progress and they may not have as much work to do. This is not completely the fault of the teacher. Teachers must meet all points of the curriculum and stay on a strict track of learning²⁹. This does not allow for the freedom to teach creatively. The creative teacher may be seen as less of an authority figure³⁰. From the teacher's perspective, a student's creative behavior may be seen as bad manners or challenging³¹. It is necessary for the teacher to be secure and to be creative to allow for creativity. In a study of 500 students, creativity of the teacher was one of the more highly valued traits of the teacher. The study found creativity to be correlated to teacher

²³ Davies T.: Taking Risks as a Failure of Creativity in the Teaching and Learning of Design and Technology. "The Journal of Design and Technology", Vol. 4, No. 2, 1999, p. 101-108.

²⁴ Malaguzzi L.: The Hundred Languages of Children (I Cento Inguaggidei Bambini. Exhibition Catalogue).

²⁵ Christensen C., Johnson C.W., Horn M.B.: *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*. McGraw Hill, New York 2008.

²⁶ Beghetto R.A.: Does Creativity Have a Place in Classroom Discussion? "Prospective Teachers' Response Preferences, Thinking Skills and Creativity", Vol. 2, 2007, p. 1-9.

²⁷ Davies T.: Taking Risks as a Failure of Creativity in the Teaching and Learning of Design and Technology. "The Journal of Design and Technology", Vol. 4, No. 2, 1999, p. 101-108.

²⁸ Runco M.A.: Implicit Theories, [in:] Runco M.A., Pritzker S.R. (eds.): *Encyclopedia of Creativity*. "Academic", Vol. 2, San Diego-London 1999, p. 27-30.

²⁹ Ng A.-K., Smith I.: Why is There a Paradox in Promoting Creativity in the Asian Classroom?, [in:] Lau S., Hui A.N.N., Ng G.Y.C. (eds.): *Creativity: When East Meets West*. World Scientific Publishing Company, 2004, p. 87-112.

³⁰ Beghetto R.A.: Does Assessment Kill Student Creativity? "The Educational Forum", Vol. 69, 2005, p. 254-263.

³¹ Ng A.K., Smith I.: Why Is There a Paradox in Promoting Creativity in the Asian Classroom?, [in:] Lau S., Hui A.N.N., Ng G.Y.C. (eds.): *Creativity: When East Meets West*. World Scientific Publishing Company, 2004, p. 87-112.

effectiveness³². It is necessary to take an updated look at traditional teaching methods and create new methods which will better suit students and enhance creative learning³³.

Conclusions

For the majority of professions, innovativeness and creativity are major assets³⁴. Therefore, we must foster its development. We need to raise our children and teach our students while nurturing their creativity. This will have a great positive impact on them both socially and economically. It will also foster economic growth.

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³² Westby, E. L., & Dawson, V. L., Creativity: Asset or Burden in the Classroom?, *Creativity Research Journal*, vol. 8, no.1, 1995, pp. 1-10.

³³ Milgram, R. M., Creativity: An Idea Whose Time Has Come and Gone. In R. S. Albert & M. A. Runco (Eds.), *Theories of Creativity*, NY; London: Sage Publications. New York/ London: Sage Publications, 1990, pp. 215-233; Clifford, M., 30 Things You Can Do to Promote Creativity, *informED*, November, 26, 2016, www.opencolleges.edu.au/informed/features.30-things-you-can-do-to-promote-creativity-in-your-classroom [DOA: 07.01.2017].

³⁴ Wolniak R.: The role of QFD method in creating innovation, „Systemy Wspomagania Inżynierii Produkcji”, z. 3, 2016, s. 127-134; Wolniak R.: Relationship between selected lean management tools and innovations, *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, z 75, 2014, s. 157-266; Wolniak R., Skotnicka-Zasadzień B.: The use of value stream mapping to introduction of organizational innovation in industry, „Metalurgia”, vol 53., iss. 4, 2014, s. 709-712; Wolniak R.: Innovation in the context of economic situation in the EU countries, „Zeszyty Naukowe Akademia Morska w Szczecinie”, nr 24 2010, s.141-147; Wolniak R., Sędek A.: Using QFD method for the ecological designing of products and services, „Quality and Quantity”, vol 43, nr 4, 2009, s. 695-701.

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