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A THEORETICAL REVIEW OF CREATIVITY BASED ON AGE

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El objetivo de este estudio fue realizar una revisión sistemática en la literatura científica existente sobre la creatividad en función de la edad, haciendo especial énfasis en las diferencias que se presentan entre cada etapa evolutiva del desarrollo humano, comprobando si existe disminución de esta capacidad a lo largo de la vida. Se realizó una revisión bibliográfica en las bases de datos, Web of Science, Scopus y PsycINFO, tomando en cuenta publicaciones realizadas entre 2010 y 2017 en español o inglés. Se seleccionaron 25 artículos que se analizaron en base a diferentes características como los instrumentos empleados. Los resultados muestran heterogeneidad en los hallazgos y se discuten los resultados tratando de arrojar luz sobre la comprensión de los mismos.

Palabras clave: Creatividad, Pensamiento divergente, Edad, Desempeño.

The objective of this study was to carry out a systematic review of the existing scientific literature on creativity based on age, with special emphasis on the differences that occur between each evolutionary stage of human development, checking whether there is a decrease in this capacity over a lifetime. A literature review was carried out using the databases Web of Science, Scopus and PsycINFO, taking into account publications produced between 2010 and 2017 in Spanish or English. We selected 25 articles that were analyzed based on different characteristics such as the instruments used. The results show heterogeneity in the findings. We discuss the results, attempting to shed light on their interpretation.

Key words: Creativity, Divergent thinking, Age, Performance.

DEVELOPMENT OF CREATIVITY ACCORDING TO AGE

Creativity is a complex skill that allows the generation of original and innovative ideas in resolving various situations in the daily lives of human beings, and is, thus, an essential skill in the process of adaptation of the individual in a rapidly-changing society (Cassotti, Camarda, Poiriel, Houdé, & Agogué, 2016). Creativity, in a broad sense, is framed in the creation of unique and authentic products, with a high value thanks to their usefulness and applicability (Kapoula et al., 2016). The individual is constantly developing this skill throughout the whole of their life and in a different way in each evolutionary stage, thus, the development of this capacity depends on the chronological age and the cognitive functions, since there is a significant relation between neuropsychological maturity and creativity (Ramírez Villén, Llamas-Salguero, & López-Fernández, 2017).

Experience, education, and social environment, among other aspects, may cause the subject to have a greater capacity for creativity. Therefore, each evolutionary stage presents its own qualitative characteristics during the development of the creative processes (Artola et al., 2011). Creativity is a complex and

essential process that occurs in different areas of the brain and requires the development of cognitive functions and higher order thinking skills to identify problems and present alternative solutions to achieve a final product (López-Fernández & Llamas-Salguero, 2018). It is a transforming capacity, originator of successful and transcendental alternatives that build and create the subject and objects (Lara-Coral, 2012).

Creative processes are expressed in different ways in each of the evolutionary stages, so children manifest creativity in a different way from adolescents or adults (Woodell-Johnson, Delcourt, & Treffinger, 2012). Therefore, depending on the mastery and interest that the subject has in a particular skill or subject, creative production will be higher, even regardless of the age of the individual, although there are theories that creativity diminishes dramatically in old age as found in Wei and Weihua (2013). However, creativity may be activated taking into account aspects that favor it, such as cognitive bases consolidated by experience and time, which may well result in a reformulation of problems and present new and appropriate solutions (Melendez, Alfonso-Benlliure, Mayordomo, & Sales, 2016).

As can be seen from the comments made, the studies carried out show heterogeneity regarding the relationship between age and creativity. Undoubtedly this is because creativity is a complex construct, which includes different skills such as, for example, the central ones proposed by Guilford: fluency, originality, flexibility and elaboration.

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Understanding how creativity develops throughout the life cycle is relevant in order to stimulate and enhance it. Alfonso-Benlliure and Romo (2016) establish that the development of creative skills is essential in the school stages of the child, noting, however, that specific studies have not yet been generated with regard to the development of creativity in the different evolutionary stages that allow us to affirm the form in which this process takes place throughout life.

Taking into account the neuropsychological aspect of the development of creativity, it is important to note that the prefrontal cortex has a predominant role in the generation of this capacity, which takes into account relevant aspects such as cognition, motivation and socio-affective factors (Kapoula et al., 2016). However, it is noteworthy that, as a complex process, creativity requires several brain areas to converge (López-Fernández & Llamas-Salguero, 2018). Thus, depending on the neuropsychological maturity and the experiences of the subject, creativity presents higher percentages at each evolutionary stage, which must be taken into account at all times.

Based on the above, the objective of this study was to conduct a systematic review of the scientific literature on creativity based on age, taking into account the different characteristics (such as instruments, context, etc.) used in the studies themselves, in order to shed light on the relationship between creativity and age and the circumstances in which this relationship is evidenced or not.

METHOD

A literature review was carried out in the Web of Science, Scopus and PsycINFO databases, taking into account the filter years 2010-2017 in English and Spanish, with "creativity and age" as the main search criteria. However, aspects related to creative thinking such as "divergent creative thinking and age" were also taken into account. Additionally, the evolutionary stages were also related, using the terms "creativity in childhood, adolescence, adults OR young and older adults". Experimental investigations that emphasize the development of creativity based on age were taken into account, selecting articles within the social sciences domain.

The selection criteria of the articles included those that focus on creative performance in the evolutionary stages, and special attention was given to studies that explicitly reveal possible comparisons between the stages with regards to creative production processes, or that present results of creative performance during certain phases of life. Articles that did not make such comparisons were eliminated. Using these inclusion criteria, 25 articles were obtained, which are analyzed in this study.

This method of bibliographic review establishing inclusion criteria has been used in recent studies such as Lisbona Bañuelos, Palací Descals and Castaño (2016).

RESULTS

The articles reviewed focus on certain stages of the evolutionary development of a subject, taking into account their performance in carrying out different tasks that allow their

creative processes to be measured. Thus, in the samples there are participants in the stages of childhood, adolescence, youth, adulthood, and old age.

The studies are presented in two tables where the sample, instruments, and results are shown. The data presented in Table 1 show the main data of the studies, such as author, year, sample and instruments used. Table 2 presents the results based on age and the variables that affect the creative processes, taking into account the context as an important factor in the development of the creative processes in the different evolutionary stages and recognizing that this aspect has an important influence in the results of the studies.

DISCUSSION

Each evolutionary stage of the subject has certain characteristics with regard to the performance of creative tasks. Thus, this performance is not the same in the child as in the adult, and in turn there are differences between similar ages, since experience provides more elements to produce more elaborate and innovative alternatives, although these could also be due to the use of different strategies (Privodnovaa & Volf, 2016). On the other hand, it is shown that creativity can decrease significantly during old age, although not before 70 years since it is during the period between 40 and 70 years of age where divergent thinking is stabilized. Even when creative productivity does not have this measure, it is recognized that during old age the overall creative performance may decrease (Palmiero et al., 2014), although this also depends on variables such as health, cognition, attitude, type of task, educational level, mastery, etc. (for example, Elisondo & Donolo, 2018).

While performing tasks focused on the core skills of creativity, there are some differences, so for example originality is greater in children that are 4-5 years of age than in those aged 10 (Delveccio et al., 2016), and in people older than 65 years, this characteristic also stands out over other ages (Madore et al., 2016; Kuo & Yeh, 2016).

With regards to fluidity and flexibility, some studies find that there are no differences according to age (Madore et al., 2016; Palmiero et al., 2014) but others do find favorable differences in older subjects (Alfonso-Benlliure & Romo-Santos, 2016). Even the study by Cassotti et al. (2016) shows lower scores in older subjects, but in circumstances in which subjects are given a concrete example. In this sense, Meléndez et al. (2016) argue that in subjects aged between 55 and 84, the differences may depend more on variables such as cognitive reserve and openness to experience than on age, particularly in verbal tasks. And this is the case even regarding other variables such as having a learning difficulty, such as dyslexia (Kapoula et al., 2016).

As for imagination, it seems that the ages of 6 to 10 show better results (Delvecchio et al., 2016), no differences being found between young and old adults (Madore et al., 2016).

Adolescence may stand out for the characteristics of processing and transformation (Gundogana et al., 2013) probably due to the increase in the visuospatial domain



TABLE 1
BASIC DATA ON CREATIVITY BASED ON AGE

Authors	Journal and year of publication	Sample	Instruments
Delvecchio, Li, Passiagli, Lis, & Mazzeschi	Frontiers in Psychology (2016)	538 (from 4 to 10 years)	1)APS -Extended version (pretend play) Organization elaboration, imagination, comfort and affect (Delveccio et al., 2016) 2) Use of 6 objects: flexibility and fluency (Guilford, 1967)
Kuo & Yeh	Frontiers in Psychology (2016)	Two experiments: 1) 64 individuals with mean age of 23.95 years 2) 32 over 65 (two groups: free and rectangular)	Unusual uses for common objects CAP, ZAFC & Hearts and flowers task (Williams, 1980)
Meléndez, Alfonso-Benlliure, Mayordomo, & Sales	Creativity Research Journal (2016)	135 from 55 to 84 years	Interview PIC A (Artola et al.,2010)
Simon & Bock	Human Movement Science (2016)	25 young people and 24 elderly people	-Alternative Uses Task (AUT) (Guilford, 1967) -Sensory-motor adaptation tasks
Kapoula, Ruiz, Spector, Mocorovi, Gaertner, Quilici, & Vernet	Plos One (2016)	Dyslexic and non-dyslexic children, adolescents, and university students	Torrance Test of Creative Thinking (Torrance, 1974)
Cassotti, Camarda, Poirel, Houdé. & Agogué	Thinking Skills and Creativity (2016)	Two studies 1) 19 people from 9 to 11 years and 20 people from 18 to 22 2) 32 children and 32 adults with control and experimental groups	Egg task
Alfonso-Benlliure & Romo-Santos	Thinking Skills and Creativity (2016)	1,491 pupils from 6 to 12 years (six school years)	Test de Creatividad Infantil [Child Creativity Test] (TCI) (Romo, Alfonso-Benlliure, & Sánchez-Ruiz, 2008) Drawing visual area
Krumm, Filippetti & Aranguren	Acta Psiquiátrica y Psicológica de América Latina (2015)	432 people from 15 to 26 years	TTCT (Torrance, 1974)
Palmiero, Di Giacomo, & Passafiume	Creativity Research Journal (2014)	70 participants, 35 from 19 to 22 and 35 from 57 to 82 years	TTCT (Torrance, 1974)
Ra ki	Društvena Istraživanja (2015)	885 participants	Inventory by Željko Ra k (Ra ki, 2015)
Palmiero	High Ability Studies (2015)	150 participants	AUT (Guilford, 1967) and the CMST (Finke, 1990)
Agogué, Poirel, Houde, Pineau, & Cassotti	Sciencedirect (2014)	142 participants	Egg task
Woodel-Johnson, Delcourt, & Treffinger	Academic Onefile (2012)	109 participants	YBRAIN (Chua, 2004)
Wei & Weihua	The Journal of Creative Behavior (2013)	140 elderly people	DAC (Hultsch, Hammer & Small, 1993)
Madore, Jing, & Schacter	Memory & Cognition (2016)	24 young adults and 24 older adults	AUT (Guilford, 1967)
Leon, Altmann, Abrams, Gonzalez Rothi, & Heilman	Creativity Research Journal (2014)	30 young adults and 30 older adults	AUT and AF (Guilford, 1967)
Bijvoet-van den Berg & Hoicka	Developmental Psychology (2014)	24 children	TCP (Torrance, 1966)
Robson & Rowe	International Journal of Early Years Education (2012)	30 children	Analyzing Children's Creative Thinking (ACCT): creative inference through behavior
Gündoğana, Yalınkaya, Arib, & Gönen	Educational Sciences: Theory and Practice (2013)	1,000 children between 9 and 14 years	TCI (Gündoğana et al.,2013)



TABLE 1
BASIC DATA ON CREATIVITY BASED ON AGE (Continuation)

Authors	Journal and year of publication	Sample	Instruments
Kleibeuker, De Dreu, & Crone	Developmental Science (2013)	98 participants	The Snowy Picture Test (Eckstrom, French, Harman, & Dermen, 1976), RAT (Mednick, 1962), AUT and CAT (Guilford, 1967)
Wei & Dzeng	Psychological ReportsEducational (2013)	1,055 participants	Creativity Test and Scoring Scale, People-drawing Test Scorings Scale, and Free-drawing Test and Scoring Scale (Lin & Wei, 2012)
Privodnovaa & Volf	Human Physiology (2016)	160 participants	AUT (Guilford, 1967)
Hui, Yeung, Sue-Chan, Chan, Hui, & Cheng	Developmental Psychology (2014)	594 individuals	CPS (Cheng, 2002)
Kleibeuker, Stevenson, Van Der Aar, Overgaauw, Duijvenvoorde, & Crone	Developmental Psychology (2016)	32 participants	AUT (Guilford, 1967) LGT (Kleibeuker et al., 2016)
Stevenson, Kleibeuker, De Dreu, & Crone	Frontiers in Human Neuroscience (2014)	71 adolescents and 61 adults	Creative ideation AUT Combined Alternative Uses/Ordinary Characteristics Task General ideation (Guilford, 1967)

TABLE 2
MAIN RESULTS OF THE STUDIES ON CREATIVITY BASED ON AGE

Study	Results
Delvecchio et al. (2016)	The highest scores in originality and elaboration are in the range of 4 to 5 years. The highest scores in imagination and comfort are in children aged 6 to 10.
Kuo & Yeh (2016)	The older adults in the free walking group surpassed the young adults in the rectangular walking group in originality and had equal performance in fluency and flexibility.
Meléndez et al. (2016)	Subjects with greater cognitive reserve and openness to experience were more flexible and original when solving verbal problems, although, to a lesser extent, graphic problems.
Simon & Bock (2016)	Young people scored higher than older people in all tasks. The AUT scores were positively associated with the adaptive performance of the young participants, but not in the older ones. The scores were negatively associated with the adaptive performance of the older participants, not the younger ones.
Kapoula et al. (2016)	Dyslexics more creative Age: there was no effect on the creativity of the non-dyslexic participants, but there was on the dyslexic ones, who were more creative at ten years of age (probably because they can initiate compensatory mechanisms in response to their difficulties, as occurs in adults, due to strategy).
Cassotti et al. (2016)	Adults were limited using the example (flexibility) and gave more answers in the same category than the children. In the second study, the adult control group performed better in fluency and flexibility than the control group of children. In the experimental group (with the example) the children obtain better fluency and flexibility and originality than the adults. Thus, age does have an influence depending on the task
Alfonso-Benlliure & Romo-Santos (2016)	The results show three types of trajectories: with highs and lows, stable, and association and development
Krumm et al. (2015)	Older age, greater fluency, flexibility and originality and overall
Palmiero et al. (2014)	No difference by age in the verbal part, only in visual fluency Older adults may think more divergently than younger participants, although the former produce fewer visual ideas.
Ra ki (2015)	The results showed an identifiable mastery of creative behavior in children, also, according to sex, there are differences in the averages of mastery with respect to age, and the close relationships of commitment to the task and the acquisition of knowledge with creativity. The conclusions of this study are related to the definition and measure of creativity in the educational context.



(Kleibeuker et al., 2013), neuropsychologically related to the central regions of the brain for creativity (SMG, AG and MTG), which are constantly restored at this age. Thus, adolescence is a key stage in learning processes that promote divergent thinking (Kleibeuker et al., 2016).

Creativity is a process that is developed through the neuropsychological maturity of the subject, the consolidation of the cognitive functions facilitates the performance of novel and original tasks (Ramírez Villén, Llamas Salguero, & López-Fernández, 2017). Taking the above into account, it is found that as age increases the average in the central skills of creativity also increases. Thus, when the child starts school, creative capacity increases thanks to sociocultural interactions and the consolidation of cognitive functions (Krumm, Filippetti, & Aranguren, 2015). Likewise, Wei and Dzung (2013) in a study conducted with 1,055 children between 6 and 8 years of age

found that older children score higher on creative drawing tests, albeit with similar qualifications in general creativity.

In an investigation carried out by Bijvoet-van den Berg and Hoicka (2014) it was found that, during childhood, fluency and originality tend to increase with age, perhaps as a result of the development of fine motor skills during this stage, between 4 and 5 years, which allows them to carry out more elaborate actions, enabling them to recognize a high range of possibilities to perform various tasks. On the other hand, Rubson and Rowe (2012) found that the youngest children between 3 and 4 years are directly influenced by their environment in the performance of creative tasks, thus, adult support has a fundamental role in the development of creative abilities. The results found in a study carried out with pre-school and primary school children establishes that primary school children could organize tasks that involved divergent thinking more effectively, being able to

TABLE 2
MAIN RESULTS OF THE STUDIES ON CREATIVITY BASED ON AGE (Continuation)

Study	Results
Palmiero (2015)	In particular, divergent verbal thinking seems to stabilize from 40 to 80 years of age, while the ability to create objects falls dramatically only after the age of 70. This means that older people have the potential to express creativity and can use this potential to improve their lives.
Agogué et al. (2014)	It was proposed to model fixation as a game of restrictive heuristics where a creative task was used to apply the theoretical framework and characterize the effects of fixation, showing how individuals are fixated in different ways according to age, and these same individuals of the same age differ in the way they are fixated based on the type of education they received.
Woodel-Johnson et al. (2012)	The results of the data analysis show that the majority of professional students have the strongest predisposition towards creative thinking (59%). No association was found between thinking styles and gender. However, thinking style is associated with academic achievement.
Wei & Weihua (2013)	Creativity decreases with age, however, factors related to education, health, daily activities and attitude are important variables of these results.
Madore et al. (2016)	No general age-related differences were observed in any of the tasks.
Leon et al. (2014)	Older adults presented more original responses than young adults.
Bijvoet-van den Berg, & Hoicka (2014)	The divergent thinking of children increases with age.
Robson & Rowe (2012)	The creative aspects take place to a greater extent in activities carried out on their own initiative. On the other hand, participative activities are associated with the direction of the adult who provides support and guidance.
Gündoğana et al. (2013)	In the Creation and Transformation subscale within the test, it was found that the number of forms used increased gradually with increasing age.
Kleibeuker et al. (2013)	The conclusion was reached that in middle adolescence there are creative potentials in the visuo-spatial domain, possibly related to the development of control functions and exploratory behavior.
Wei & Dzung (2013)	The results showed that the older children scored higher than the younger ones on the people-drawing and free drawing test, but not on creativity in general. Drawing and creativity scores increased according to age.
Privodnovaa & Volf (2016)	The elderly subjects showed lower -desynchronization of the anterior areas of the brain in the initial stage of creative thinking compared to the young participants. Age-related changes in oscillatory activity may be the basis for different strategies for solving the creative task in young adults and older adults.
Hui et al. (2014)	The groups of middle age and the elderly thought that creative productivity would decrease at a later age.
Kleibeuker et al. (2016)	The results indicate that the central regions of the brain for creativity (SMG, AG and MTG) are constantly restored in adolescence and that changes in performance are associated with changes in activation in the lateral prefrontal cortex.
Stevenson et al. (2014)	The results show that the generation of creative ideas can be improved and supports the hypothesis that adolescence is a stage of development of greater flexibility, optimized for learning and exploratory behavior.



use fantasy to a large extent to reconstruct reality and their own experiences (Delvecchio, Li, Passiagli, Lis, & Mazzeschi, 2016).

The tasks focused on playing and the construction of stories reveal to a large extent the creative abilities in children. Thus, imagination and fantasy are aspects of great importance in the performance of activities that involve divergent thinking. Therefore, when this aspect is evaluated, younger children reach higher scores than older children, with a high average of originality Delvecchio, Li, Passiagli, Lis, & Mazzeschi (2016). However, research carried out by Alfonso-Benlliure and Romo (2016) establishes that imaginative potential increases with age, since it is with age and time that learning and cognitive functions are nurtured.

During adolescence there is a decrease in the development of creative processes, which may be due to the attitudes and interests of the subjects. However, at the end of this stage such processes will be re-established (Krumm et al., 2015). Among the findings made by Kleibeuker et al. (2013) it is found that verbal divergent thinking and creative vision develop until late adolescence, but, fluency and flexibility tend to reach a high level comparable with the adult; in the same way, divergent visuospatial thinking has a higher performance at the age of 15 and 16 years.

Taking into account the previous postulates, it is found that the central skills of creativity that are found in greater measure in adolescence are seen in flexibility. In addition, the performance levels of creative tasks are conditioned by the organization and maturation of the cognitive functions that take place during this stage (Kleibeuker et al., 2016). On the other hand, for young adults, the social and educational context plays a fundamental role, since creativity is manifested by their work and professional performance. For example, journalists or lawyers have higher percentages in fluency and physicians in originality (Stevenson et al., 2014).

Divergent thinking reaches its highest point at the age of 40 and can be preserved for several more years, according to studies conducted with 70 subjects aged between 35 and 82 years by Palmiero, Di Giacomo, and Passafiume (2014). Normally, during middle adulthood between the ages of 40 and 60 there are important cognitive levels, produced in general knowledge or semantic memory, that allow the subject to perform divergent thinking tasks fluently. Madore, Jing and Schacter (2016), in general, establish that during adulthood there is a stability in the divergent thinking process that may depend on the social, professional or work aspects of the subject, which may even reach up to 70 years, however, the generation of creative actions diminishes significantly after 70 years of age (Palmiero, 2015).

According to the studies conducted, it is found that divergent thinking is maintained even during old age. Although flexibility and fluency may decrease, it is also evident that the quality of responses is high (related to originality), so during old age divergent thinking can be performed effectively, equally as well as in youth (Palmiero, 2015). On the other hand, Leon, Altmann, Abrams, Gonzalez-Rothi, and Heilman (2014),

emphasize that divergent thinking is conditioned by frontal functions and, when the functions of these brain regions such as fluency begin to decline, this type of thinking can degrade. Thus, the responses of the subjects that are more advanced in age are hindered.

In studies conducted by Wei and Weihua (2013) with 140 elderly subjects, it is established that creativity decreases with age; it is shown that in old age the responses to creativity tasks are low, however, factors related to education and health greatly influenced the averages obtained, such that adults with higher educational levels had better scores in creative tasks. Privodnovaa, Volf, and Knyazev (2018) establish that cognitive functions during old age are conserved for a significant amount of time, while they recognize that processing speed can be degraded to a great extent; however, the results of their studies showed that older adults resolved divergent processes faster than young adults.

According to research conducted by Palmiero et al. (2014), it is affirmed that verbal skills do not decline in old age, since the measure is the same as those obtained by young people, performing tasks of divergent verbal thinking and creativity significantly; on the other hand, no differences were found in visual divergent thinking. Based on the above, Palmiero (2015) finds that during old age there is high creative potential, which can improve the living conditions of the subject, which is why many welfare programs for adults in old age are based on performing creative tasks such as painting, writing, or acting in order to improve health conditions and quality of life in general.

CONCLUSIONS

Although more studies are needed to homogenize the results found regarding the relationship between age and creativity, the analysis carried out in this work aims to shed light on this field. Thus, based on the studies analyzed, it is deduced that creativity can be expressed in different ways during each of the stages of the subject, and this idiosyncrasy must be taken into account together with other factors that intervene in the studies carried out. When comparing the results obtained by using similar instruments to evaluate specific skills, the results take on meaning in conjunction with the characteristics of those studies, and the consideration that creativity decreases in old age is questionable, which is why it is important to use evaluation instruments based on the physical changes of old age. Therefore, we believe that this work is a small contribution that can facilitate our understanding of how creativity relates to age, with the aim of avoiding generalizations in such a complex issue.

However, there are numerous limitations in this work, which must be corrected in future studies, thus opening the door to new research. That is, when talking about creativity, the exact characteristic to which we are referring must be made explicit, in order to facilitate comparisons, using instruments that are comparable and that can also be of a ludic nature to increase the ecological validity. In addition, it would be useful to control other variables that may influence the results such as cognitive



reserve, processing speed, environment and context, educational level, intelligence, personality, the use of strategies, the task to be performed, health, and activities of daily living, since these all seem to influence the results as has been discussed. Taking these aspects into account will help us to generate more clarifying and specific hypotheses.

CONFLICT OF INTERESTS

There is no conflict of interest.

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