Importance of creativity and learning in preservice teachers

Cristina de la Peña Álvarez [1]

[1] International University of La Rioja (UNIR)

Spain

Correspondence: Cristina de la Peña Álvarez. Universidad Internacional de la Rioja (UNIR). E-mail: cristina.delapena@unir.net

Cristina de la Peña Álvarez

Abstract

Introduction. A current review of the scientific literature reveals that creativity and learning are interrelated; learning is a creative process that involves fundamental, significantly personal changes at all stages of education, but especially in higher education, where it promotes university students' future employability. The objective of this study was to analyze the relationship between creativity and academic achievement as a measure of learning.

Method. The sample was composed of 100 university students in Primary Education teacher training at the University of Castilla la Mancha (UCLM) (40% male and 60% female), between the ages of 19 and 24 years. All participants were administered the PIC-A test to assess creativity and they reported their university admissions test score as a measure of academic achievement. Descriptive statistics, Pearson correlations and multiple linear regressions were used.

Results. The results showed a significant positive correlation between the university admissions test score and general creativity, narrative creativity, fantasy, fluency and flexibility. Moreover, general and narrative creativity as well as fantasy, fluency and flexibility predicted academic achievement.

Discussion and conclusions. These findings have educational implications for improved learning in preservice teachers, seeking to equip them with creative teaching strategies and to improve their employability.

Key words: creativity, learning, academic achievement, university education, primary school teachers

Resumen

Introducción: Actualmente, la revisión de la literatura científica pone de manifiesto la interrelación entre la creatividad y el aprendizaje; siendo el aprendizaje un proceso creativo que implica nuevos cambios significativamente personales fundamentales en todas las etapas educativas, pero sobretodo en la educación superior, promoviendo la empleabilidad del alumnado universitario. El objetivo de esta investigación es analizar la relación entre la creatividad y el rendimiento académico como medida del aprendizaje.

Método: La muestra estuvo conformada por 100 estudiantes universitarios del Grado de Educación Primaria de la Universidad de Castilla La Mancha (UCLM) (40% chicos y 60% chicas) con edades comprendidas entre 19 y 24 años. A todos los participantes se les administra la prueba PICA para evaluar creatividad y autoinforman de la nota de la prueba de acceso a la universidad para medir rendimiento académico. Se emplearon estadísticos descriptivos, correlación de Pearson y regresión lineal múltiple.

Resultados: Los resultados obtenidos evidencian correlación significativa positiva entre la nota de la prueba de acceso a la universidad y la creatividad general, creatividad narrativa, fantasía, fluidez y flexibilidad. Además, la creatividad general y narrativa así como fantasía, fluidez y flexibilidad predicen el rendimiento académico.

Discusión o conclusión: Estos hallazgos tienen implicaciones educativas para potenciar el aprendizaje de los futuros maestros, dirigidas a la enseñanza de estrategias creativas y a su empleabilidad.

Palabras Clave: creatividad, aprendizaje, rendimiento académico, educación universitaria, maestros

Introduction

In recent years, international institutions such as the Organization for Economic Cooperation and Development (OECD, 2016) have stressed the importance of promoting creativity in the classroom. Development of creativity in students is considered a requirement to improve educational quality, and hence, society itself.

In the university context, the two interrelated constructs of creativity and learning must be optimized with a view to job market access and the constant, ongoing social changes. The two processes both involve changes: Creativity refers to new changes in products, objects, methods or solutions to problems (Nami, Marsooli & Ashouri, 2014) and learning involves changes in understanding and in relatively stable behaviors (Alexander, Schallert & Reynolds, 2009). Consequently, creativity and learning are connected, where learning is a creative process that results in personally significant changes in one's previous understanding (Berghetto, 2016). This link between creativity and learning may lead us to assume that there is a relationship between creativity and measures of learning outcomes such as academic achievement. Such academic achievement is a multidimensional product in which one must consider the influence of diverse internal and external variables, taking into account the process and product of learning, as well as intervening factors (González Barbera, Caso Niebla, Díaz López & López Ortega, 2012). In recent years, an intelligence test called the Aurora Battery has been developed and applied, integrating the assessment of analytical, practical and creative intelligence. Test scores correlate with academic achievement, offering evidence that academic achievement, as a measure of learning, requires the use of cognitive functions, and goes beyond mere knowledge of subject matter (Llor Zaragoza, Ferrándiz García, Ferrnado Prieto & Fernández, 2013).

Is there a relationship between creativity and academic achievement in higher education?

The scientific literature reveals much interest in studying the relationship between creativity and academic achievement. Following is an analysis of previous studies on this topic, first describing studies that find a relationship between creativity and academic achievement in higher education, and second, studies that find no relationship between creativity and academic achievement in higher education.

In the former category, Nami, Marsooli and Ashouri (2014) explored the relationship between creativity and academic achievement in a sample of 72 English-speaking university students. For this purpose, they took measurements using a creativity questionnaire and students' grade point average, and found that creativity, as well as the components of creativity, namely, fluency (r=.67), flexibility (r=.83), innovation (r=.87) and extension of creativity (r=.44), had a significant positive relationship to academic achievement (r=.76).

Naderi, Abdullah, Aizan, Sharir and Kumar (2009) examined creativity, age and gender as predictors of academic achievement in a sample of 153 university students from Iran; they administered the Khatena-Torrance Creative Perception Inventory (KTCPI), which is a self-perception questionnaire, and used students' mean score on the mid-year exams. Their results indicated that creativity, age and gender accounted for 14% of academic achievement, that there was a low but significant relationship between creativity and academic achievement (r=.15), and that there were no significant differences between gender and academic achievement.

Matthew and Stemler (2013) proceeded to analyze flexible thinking, defined as the ability to solve novel problems in unfamiliar settings, in a sample of 299 U.S. students. They used measurements from a new word recognition test for measuring flexibility, the Abbreviated Torrance Test for Adults (ATTA) for creativity, and the Stanford achievement test (verbal, mathematical, writing and university admissions test score) and grade point average for academic achievement. Additionally, other tests were used to assess cognitive abilities, such as Raven's progressive matrices test, the Mill-Hill vocabulary scale and the embedded figures test. In relation to our study topic, their results included a low but significant positive relationship (r=.17) between creativity and academic achievement in mathematics and writing, and the word recognition test explained 4.5% of academic achievement.

Chooi, Long and Thompson (2014) sought to verify whether the Sternberg Triarchic Abilities Test could be used as an instrument to measure intelligence. In a sample of 356 university students in the United States, they used the Sternberg Triarchic Abilities Test to measure analytical, practical and creative intelligence; and for academic achievement, the self-reported university admissions test score, Stanford achievement test score, and grade point average. They carried out structural equations and indicated that Sternberg's triarchic abilities

may be a measure of "g", and that it had significant moderate, positive correlations with the university admissions test score (*r*=.47) and with grade point average (*r*=.29).

In a 2008 study, Sternberg sought to verify whether academic achievement in 793 U.S. university students was improved by intelligence that successfully integrated creative skills. The Sternberg Triarchic Abilities Test was used to measure creativity, and for academic achievement, they used the Stanford achievement test along with grade point average for the first year at university. Among the results obtained, they found a significant moderate, positive relationship between creativity and academic achievement (*r*=.50).

Day, Hanson, Maltby, Proetor and Wood (2010), in a sample of 129 British university students, wished to analyze whether hope was a predictor of academic personality and of academic achievement. To address this objective, they used different measures, such as a trait hope scale, the Big Five personality test, Raven's progressive matrices, Guilford's test of divergent thinking, and for academic achievement, the university admissions test score and final grade point average. One of the results was a small but significant, positive relationship between creativity and academic achievement as measured by university admissions test score (*r*=.20) and by final grade point average (*r*=.31).

Pishghadam, Khodadady and Zabihi (2011) carried out a study with 272 Iranian university students in order to analyze creativity and foreign language learning; to do so, they administered Arjomand's creativity questionnaire which measures the student's self-reported creativity, and used the student's average grade in English as a Foreign Language (EFL) to measure academic achievement. Their results showed a small but significant, positive relationship between creativity and academic achievement in EFL (*r*=.36).

Pretz and Kaufman (2015) carried out a study with U.S. university students, where the sample varied depending on the instrument applied, in order to investigate the relationship between university admission criteria and creativity in the students admitted. In order to analyze this objective they used several creativity measures, including Guilford's test of divergent thinking and a creative self-efficacy questionnaire, and for measuring academic achievement, the Stanford achievement test (critical reading, writing and mathematics), secondary school grade point average, and the score obtained on their admissions interview, carried out by expert admissions counselors. Results indicated that all measures of the Stanford

achievement test were significantly related to the creativity measures, both Guilford's thinking test and the creative self-efficacy questionnaire; the strongest magnitudes, however, were produced between the Stanford test results and the students' self-reported creativity measurement. Specifically, creativity explained 22% of academic achievement in mathematics, 15% of academic achievement in critical reading, and 6.5% of academic achievement in writing.

Tatlah, Aslam, Ali and Iqbal (2012) investigated the role of emotional intelligence and creativity in the academic achievement of 235 Pakistani business students. They used Nicola's creative cognition inventory (self-reported by students), Wong and Law's emotional intelligence scale, and grade point average reported by the corresponding university department. The results obtained indicated that creativity and emotional intelligence predicted 3% of academic achievement.

Dollinger (2011) analyzed whether university admission test scores in a sample of 492 American university students were predictive of creativity. To measure creativity, they used Hocevar's creative behavior inventory (self-report) and a test of drawings and slideshows scored by judges; for academic achievement, they used university admissions test scores. Results indicated a small but significant, positive relationship between creativity and academic achievement ($r=.17$), showing that the university admissions test score can predict students' creative products and processes.

The doctoral dissertation by Wang (2007) investigated a possible relationship between learning, teaching and creativity in 216 university students in the United States. To measure these variables, they administered the Abbreviated Torrance Test for Adults (ATTA) to measure creativity, and the university admissions test score and California test of basic educational skills to assess academic achievement. Results indicated that the factors of originality and creative elaboration had a significant but low positive relationship with academic achievement in reading comprehension ($r=.27$).

Chamorro-Premuzic (2006) investigated whether creativity and conscientiousness were predictive of academic achievement in 307 British university students; to do so, they administered Christensen's Test of alternative uses to measure creativity, the Big Five personality inventory to measure conscientiousness during the first year of university, and for academic achievement, the average of the student's grades on written exams, continuous as-

sessments and graduation thesis. Results indicated a small but significant, positive relationship between creativity and academic achievement (r=.19), and that creativity was more closely related to the grade on graduating thesis than to grades on written exams or continuous assessment.

Cheung, Rudowicz, Yue and Kwan (2003) studied a sample of 859 Chinese university students to learn whether year of study influenced students' creativity. To pursue this objective, they used Guilford's test of alternative uses, a creativity self-report, and yearly grade point average. The results gave evidence of a steady declining trend in creativity over the university years, and a small but significant, positive relationship between creativity and academic achievement (r=.09), as well as a higher level of verbal creativity in students of the Humanities and Social Sciences.

Colca Ccahuana (2016) studied whether there was a relationship between students' creative thinking and their academic achievement in a sample of 82 Peruvian students pursuing a Master's in Education. She used a creativity assessment guide to measure creative thinking, and yearly grade point average, finding a significant positive relationship between creativity and academic achievement (r=.55).

In Spain, Campos and González (1994) conducted a study with 1226 university students of Fine Arts, Mathematics, Geography and History, administering the Khatena-Torrance Creative Perception Inventory. They found that creativity only predicts 4% of academic achievement, with the greatest magnitude of correlation found in Fine Arts students. More recently, Pérez-Fabello and Campos (2007) investigated whether there was a relationship between creativity and academic achievement in a sample of 57 Spanish university students. To measure creativity they used a creative imagination scale, a creative experience questionnaire, and the Khatena-Torrance Creative Perception Inventory; to assess academic achievement they used grades from the school subjects of Drawing, Sculpture, Painting and Art History. The results indicated a significant but low positive relationship (r=.27) between creative experiences and academic achievement in the subject of Drawing in Fine Arts students, where creative experience predicted 9% of academic achievement in Drawing.

As for the studies that find no relation between creativity and academic achievement in students of higher education, Balgiu and Adîr (2014) analyzed students' performance on

tests of creativity and academic achievement in a sample of 86 Romanian students pursuing a technical Master's degree. To measure creativity they used three tasks, two to measure verbal creativity and one for visual creativity; to assess academic achievement they used a multiple-choice test of technical knowledge in the subjects of Advertising, Geometry and Drawing. Their results revealed no significant general relationship between creativity as measured by the three tests and academic achievement, although at low performance levels they did find a significant relationship between originality and academic achievement ($r=.25$) and between verbal elaboration and academic achievement ($r=.29$).

Hirsh and Peterson (2008) investigated whether a precise representation of personality could predict creativity and academic achievement in a sample of 205 Canadian university students. They used the Big Five personality test, another adapted measure of the Big Five test, a creative achievement questionnaire and grade point average. Their most relevant result for this study was the lack of a significant relationship between creativity and academic achievement ($r=.01$).

Ibrahim (2012) investigated the relationship between creativity, engineering and design knowledge in a sample of 55 Engineering students in the United States. To do so, they used the Torrance test of creative thinking to measure creativity, grade point average in Engineering for academic achievement, a questionnaire on the interaction climate, and a student project evaluated by eleven judges. Among the results obtained, they found no significant relationship between creativity and academic achievement ($r=.03$). Neither creativity, nor interaction climate, nor academic outcomes had any effect on the students' design project.

Lovelace and Hunter (2013) studied a sample of 336 U.S. university students to analyze whether direction from a charismatic leader influenced their creative processes and products. Three specially designed creative tasks and the test of fluency in divergent thinking were used to measure creativity (originality and quality), and the Stanford achievement verbal and quantitative tests for measuring academic achievement. The results indicated no significant relationship between creativity and academic achievement ($r=.03$), and that a charismatic leadership style was a greater influence toward creative achievement than ideological or pragmatic leadership styles. In addition, high levels of stress diminished creative achievement in terms of quality but not in originality.

Ofili (2011) analyzed whether multicultural experiences improved creativity in students at U.S. universities. Using a sample of 122 students with 39 different countries of origin, she investigated the relationship between creativity and several factors of multiculturalism, including academic achievement. The instruments used were the creative achievement questionnaire and Duncker's problem of perception for measuring creativity, the Vancouver acculturation index, an acculturation stress scale for international students, a modified version of social support, and grade point average for measuring academic achievement. The results indicated that multiculturalism and acculturation strategies did not influence creativity, and there was no significant relationship between creativity measured by the creative achievement questionnaire and academic achievement ($r=.16$) or between creativity measured by Duncker's problem of perception and academic achievement ($r=.10$).

Zabelina, Condon and Beeman (2014) investigated the relationship of psychopathology to creative thinking and achievement. They carried out two experiments for this purpose, the second of which is related to creativity and academic achievement in addition to psychopathology. In a sample of 100 U.S. university students, they administered the creative achievement questionnaire and the Abbreviated Torrance Test for Adults to measure creativity; and for academic achievement, the Stanford achievement test score and the university admissions test score. The results indicated no significant relationship between creativity measured by the creative achievement questionnaire and academic achievement ($r=.02$) or between creativity measured by the Abbreviated Torrance Test for Adults and academic achievement ($r=.19$).

Elisondo, Chiecher and Paoloni (2018) studied the relationship between recreation, creativity and academic achievement in a sample of 132 Engineering students in Argentina. They used a sociodemographic and recreation questionnaire, the Crea test, and a questionnaire of creative actions to measure creativity; they used grade point average from the first trimester of the second academic year as the measure of academic achievement. The results indicated that the students who participated more in recreational activities had better scores in creativity, and there was no relationship between creativity measured by the Crea and academic achievement ($r=.02$) or between creativity measured by the creative actions questionnaire and academic achievement ($r=.00$).

To summarize the previous studies from the scientific literature on this research topic, we observe disparity and contradictory results as to whether there is a relationship between creativity and academic achievement in higher education. Some possible limitations that may produce this discrepancy are the way that creativity is conceptualized, as well as the type of instrument used to measure creativity and how academic achievement is operationalized. Regarding the instrument administered to students to measure creativity, some studies describe inventories or questionnaires on creativity or creative perception, constituting self-report measures, other creativity measures are direct measures, such as the tests by Torrance, Guilford, and Sternberg, and tests of divergent thinking and alternative uses. For the present study, we wished to use an objective measure of creativity that is standardized in an adult, Spanish population, and that provides a measurement for both verbal creativity and visual creativity. For this reason, the PIC-A test was selected as an objective measure of creativity, as described in the methodology section.

For measuring learning, operationalized as academic achievement, previous studies have mostly reported using a grade point average in one or several subjects from one or more academic years, followed by the use of scores from university admission tests or achievement tests. In the present study, as a measure of academic achievement in freshman students in their first months at university, we used university admissions test scores. It is true that the university admissions score does not take into account variables that may be affecting performance in this situation, but this score is used as a measurement parameter that suggests a student's achievement before receiving university training.

Why is the relationship between creativity and academic achievement in higher education important?

For Dollinger (2011), universities must seek to develop students' critical and creative thinking so that they may adapt and innovate in a society that is undergoing constant, ongoing change. However, study results in this topic reflect little application of creativity in higher education, owing to several factors, such as lack of knowledge about creative practices, resistance to change in methodology, etc. In one study, Aljughaiman and Mowrer-Reynolds (2005) found that only 50% of primary school teachers are creative, and that 35% work on creativity because it is an explicit curriculum objective. For Hossini (2011), current educational strategies lead to reduced creativity and motivation in university students.

Klimenko and Botero (2016) analyzed the creative, classroom practices of university teachers from the perception of teachers and students. To do so, they selected a sample of 49 teachers and 93 students from the disciplines of Psychology, Law, Business and Engineering. An interview was administered to teachers, to inquire about their conception of the creative student and teacher, creative teaching, creative learning, purposes of teaching, etc. They were also administered a scale specifically designed for this research, which measured the planning of teaching, methodology, teaching resources, assessment strategies and classroom climate. Students were also administered the student version of the same scale. The results showed that the teachers had a more favorable view of creative practices that they use in the classroom than did the students, whose perception of them was poor. In general, teachers perceived themselves as having deficiencies in all aspects of the scale, except for classroom climate, where scores were higher. Teachers of Law perceived themselves as less creative than did Engineering teachers. As for students, scores given for their teachers' creative practices were significantly lower in all aspects of the scale. Psychology students were the ones who perceived the least classroom creativity, as compared to Engineering students.

Klimenko and Botero (2017) carried out an investigation with 10 university teachers in Colombia, analyzing how they perceived the teaching of creativity in university classrooms from different degree programs (Psychology, Business, Law and Engineering). The teachers were administered a semi-structured interview with categories referring to the purposes of teaching, the creative student, the creative teacher, creative teaching and creative learning. Analysis of the results revealed that the teachers considered creativity to be a positive contribution to the student's university training; however, there was a general tendency among the teachers to show little responsibility for fostering creativity in their teaching practices, assigning that responsibility to the university system and to the students.

Narrowing down to teacher training degree programs, Castaño, Jenaro and Florez (2013) carried out a study with 148 preservice teachers of Early Childhood and Primary Education, concerning their perception of the importance and use of teaching practices that encourage creativity. They used a Portuguese questionnaire on creative practices, adapted it to Spanish, and designed two parallel versions, one to measure importance and the other to measure the use of such practices. The results indicated that the teacher training students perceived low use of creative practices in the classroom, although they considered it important to be familiar with strategies for developing creativity. Students in the Primary Education pro-

gram considered creative practices to be significantly more important than students of Early Childhood Education, and, by year of study, first-year students considered creative practices significantly more important than students of second, third, or fourth year. For these authors, greater effort should be made to foster creative practices in teacher training, in both university preservice training and inservice teacher develoment.

From the university environment, according to Pozo et al. (2006), professionals must be trained who can self-direct their own learning, who can learn creatively and construct transformational knowledge that serves society. In this line of thinking, it is particularly significant that university studies that prepare future teachers are not only training the teacher, but that this teacher will train children who make up the society of tomorrow. For this reason, it is important that Education students learn to understand what creativity is, how to stimulate it, and learn to develop it in the classroom (Newton & Newton, 2009). The university must teach preservice teachers to develop creative learning environments, providing opportunities to explore and experiment, fostering investigation and motivation, and introducing practical and functional tools for creative teaching that they will apply in their future classroom. For De la Torre (1996), creativity must be introduced in the teacher training curriculum, starting with training the university teachers in skills, knowledge and attitudes.

The relationship between creativity and academic achievement is important basically for two reasons. On one hand, skills like innovation and investigation must be optimized for employability, allowing graduates to more effectively cope with the demands of current society. On the other hand, university students who are training as future teachers must develop their own creative skills in order to foster them later in their students, through activities, methodologies and teaching practices that make learning more attractive, using imaginative approaches in the classroom. In order to have creative students in the classroom, there must be creative teachers.

Objectives and hypotheses

The aim of this study was to help empirically clarify the relationship between creativity and academic achievement in preservice teachers, who will become mediators of learning in children and develop their employability. Although there are different studies with univer-

sity students, there is a lack of studies that focus on preservice teachers, who will become the main source for teaching creativity in the classroom.

The specific objectives of this study were:
1) To assess creativity and academic achievement in first-year students of the Primary Education degree.
2) To study the relationship between creativity and academic achievement.
3) To analyze whether creativity predicts students' academic achievement.

The research hypotheses were:
1) There is a significant positive correlation between creativity and academic achievement.
2) Creativity predicts academic achievement.

Method

Participants

The study sample contained 100 students, 40% men and 60% women, between the ages of 19 and 24 years (M=19.37; SD= 2.25). All of them were enrolled in the first year of the Primary Education degree at the University of Castilla-La Mancha (UCLM), Spain.

The sample was intentional, selected through non-probability sampling based on accessibility; student participation was voluntary at all times.

The following sample inclusion criteria were used: enrollment as a first-year university student in Education; no presence of learning disabilities, or neurological or psychological problems; and not having taken the PIC-A during the past 6 months.

Instruments

The following assessment instruments were administered to collect the information.

Prueba de Imaginación Creativa para Adultos (PIC-A) [Creative Imagination Test for Adults] (Artolas, Barraca, Mosteiro, Ancillo, Poveda & Sánchez, 2012). The PIC-A is a test that measures level of creativity in university students of all ages. Specifically, it measures both verbal/narrative creativity and graphic creativity, and is organized into different factors: fantasy, fluency, flexibility, originality, elaboration, special details and title. The test provides

a score for each of these dimensions, as well as total scores for Graphic Creativity, Narrative Creativity and General Creativity (sum of the two preceding scores). The test contains four games, each of which is scored for one or more factors of creativity; points are added up for final scores in each of the corresponding factors. Game 1 is scored in fantasy, fluency and flexibility; Games 2 and 3 are scored in fluency, flexibility and narrative originality; and Game 4 is scored in graphic originality, elaborations, details and title. The PIC-A test has a Cronbach alpha reliability of .83. The authors' description of each aspect measured in this test is given below:

- Fantasy: the ability to imagine things that are not present on the card.
- Fluency: ability to produce ideas based on a given stimulus.
- Flexibility: aptitude to change among different topics, generating a variety of responses.
- Narrative originality: ability to create ideas that are different from the usual established ones.
- Graphic originality: aptitude for inventing different ideas from the usual established ones, but expressed through a graphic stimulus.
- Elaboration: ability to expand on and develop ideas using details.
- Special details: ability to make use of uncommon, eye-catching details in drawings.
- Title: ability to name a graphic production by creating a surprising phrase that is not merely descriptive.
- Narrative creativity: measurement of divergent thinking in verbal tasks.
- Graphic creativity: measurement of divergent thinking in nonverbal tasks.
- General creativity: an estimate of creative capability.

Academic achievement: assessed by the university admissions test score. In Spain, the university admissions test is called the EvAU; a passing score is an essential requirement for admission to university after completion of pre-university studies (*Bachillerato*). The test contains two parts:

- Mandatory part: contains four examinations covering the subjects of Spanish language and literature, History of Spain, Foreign language, and the main core subject from the educational track followed in *Bachillerato* (either Mathematics, Latin, Fundamentals of art, or Mathematics applied to the social sciences). The average score for the four subjects is the student's final test score, with a minimum of zero

and a maximum of 10. A grade of four points or more is a passing score on the admissions test.

- Optional part: allows the student to raise his/her score on the mandatory part by completing up to four optional exams pertaining to: other core subjects from the *Bachillerato* track, elective subjects, and/or another foreign language not tested in the mandatory section. These exams produce scores from 0 to 10, where 5 is a passing score, and the grade obtained for each subject is assigned a specific weight according to each university's criteria.

The final result obtained as a university admissions score is calculated based on the student's grade point average in *Bachillerato*, his/her score on the mandatory part of the EvAU, and mean score from the optional part (counting only the two highest passing scores). This final score was self-reported by students during the first months of the academic year.

Procedure

After obtaining permission from the corresponding university body, first-year Education students were informed about the study and its voluntary nature. Students who agreed to participate signed an informed consent. Following this, application of the PIC-A test was scheduled, and students' university admissions scores were recorded. The PIC-A was administered in a room with optimal light and sound conditions, instructions were provided orally, and test duration was approximately 60 minutes. All PIC-A tests were corrected by the same person in order to avoid any bias in scoring.

Data analysis

Quantitative, cross-sectional methodology was used for collecting data, given that the information was gathered at only one moment. Data were analyzed using SPSS (Statistical Package for the Social Sciences), IBM version 24 for Windows.

The statistical analyses conducted for this study were (1) descriptive analyses using descriptive statistics like mean and standard deviation to describe the values of the variables, (2) a Pearson correlation to analyze possible relationships between variables, with significance level $\alpha=.05$, and (3) a multiple linear regression analysis to investigate whether creativity or any of its factors predicted students' academic achievement.

Results

As for descriptive analyses of the study variables, Table 1 presents the mean as an index of central tendency, and standard deviation as a dispersion index, for creativity and academic achievement. According to PIC-A test data, the mean score obtained here in general creativity, narrative creativity and graphic creativity fell below values found in other groups of university students. The mean scores for academic achievement fell into the *Notable* (B) Category on a scale of 0 to 10, where <4 is fail (F), 5-6 is passing (C), 7-8 is good/*notable* (B) and 9-10 is outstanding (A).

Table 1. *Descriptive statistics and correlation between creativity and academic achievement.*

Variable	Mean	Standard Deviation	Academic achievement
Fantasy	5.11	3.13	.25*
Fluency	33.61	11.02	.26**
Flexibility	18.40	4.76	.29**
Narrative Originality	6.03	4.34	.18
Graphic Originality	2.28	1.74	.07
Elaboration	2.68	1.92	.12
Details	2.61	1.88	.16
Title	0.92	1.32	.04
Narrative Creativity	60.46	18.34	.31*
Graphic Creativity	7.70	4.65	.11
General Creativity	68.16	19.82	.31**
Mean			8.65
Standard Deviation			1.35

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

Table 1 shows the results of the Pearson correlation between the variables creativity and academic achievement. The data obtained showed admissions score in a statistically significant positive correlation, of low magnitude, with fantasy ($r=.25$), fluency ($r=.26$), flexibility ($r=.28$), narrative creativity ($r=.31$) and general creativity ($r=.31$). This implies that, the higher the score in fantasy, fluency, flexibility, narrative creativity or general creativity, the higher one's university admissions score, and vice versa.

Next, Table 2 shows the results of the multiple linear regression, using the stepwise method of variables that showed significant results. For this analysis, the criterion variable was academic achievement as measured by the university admissions test score, and predicting variables were fantasy, fluency, flexibility, elaboration, narrative creativity and general creativity.

Table 2. *Multiple regression analysis of the influence of creativity on academic achievement.*

	R²	*Beta*	*t*	*p*
General Creativity	.097	.019	3.242	.002*
Narrative Creativity	.095	.021	3.215	.002*
Fluency	.067	.032	2.657	.009*
Flexibility	.081	.081		.004*
Fantasy	.062	.108	2.553	.012*

Note: *p<.05

The results obtained indicate a significant positive predictive ability between creativity and academic achievement, showing that the more cognitively flexible students, students with higher levels of fluency and fantasy, and students with greater narrative creativity and general creativity are the students with higher university admissions scores.

The variable fantasy had a significant positive influence on academic achievement, explaining 6.2% of the admissions score and indicating that students with greater capacity for fantasy were those with higher admissions scores. The fluency variable had positive predictive ability, explaining 6.7% of academic achievement, indicating that students with higher scores in fluency had higher admissions scores. The flexibility variable explained 8.1% of the admissions score, such that students with greater cognitive flexibility were those that had higher admissions scores. The narrative creativity variable had a significant positive influence that explained 9.5% of academic achievement, indicating that students with greater levels of narrative creativity were those with higher admissions scores. Finally, the general creativity variable, that explained 9.7% of the admissions score, showed that students with higher scores in general creativity are those with better scores on the university admissions test.

Discussion and Conclusions

The objective of this research study was to analyze the relationship between creativity and academic achievement in preservice teachers studying at university. The first research hypothesis, suggesting a significant positive correlation between creativity and academic achievement, was confirmed. The results gave evidence that academic achievement operationalized as the university admissions test score was significantly correlated to general creativity and some factors of creativity: narrative creativity, fantasy, fluency and flexibility.

This finding of a significant, positive relationship between creativity and academic achievement as measured by university admissions test score is consistent with results from other studies such as Day et al. (2010), who also found a low-magnitude relationship ($r=.20$) between creativity and the university admissions test score of university students in Great Britain. Dollinger (2001), in a sample of U.S. university students, found a significant, low magnitude relationship ($r=.17$) between creativity and university admissions score. Cheung et al. (2003) found a relationship of moderate magnitude ($r=.47$) between creativity and university admission test scores in U.S. university students. The results obtained in this study also point in the same direction as research that used grade point average from one or several school subjects to measure academic achievement. Naderi et al. (2009) found a small but significant, positive relationship between creativity and the academic achievement of half an academic year ($r=.15$); Pishghadam, Khodadady and Zabihi (2011) found a low but significant positive relationship ($r=.36$) between creativity and average grade in English as a Foreign Language; Pérez-Fabello and Campos (2007) found a small but significant, positive relationship between creativity and academic achievement as average grade from the subjects of Drawing, Sculpture, Painting and Art History ($r=.27$); and Colca Ccahuana (2016) obtained a significant, positive relationship ($r=.04$) between creativity and academic achievement as the grade point average of four academic years. The data obtained in this study and in the studies mentioned above reveal that the magnitude of the relationship between creativity and academic achievement is low, at similar levels regardless of how academic achievement is measured, in other words, whether operationalized as the university admissions test score or as a grade point average.

As for the results that show positive relations between academic achievement and factors of creativity, such as fantasy, fluency and flexibility, these concur with data found by Nami, Marsooli and Ashouri (2014), who found relations of moderate magnitude between

fluency and academic achievement (r=.67) and of high magnitude between flexibility and academic achievement (r=.83) in university students. Matthew and Stemler (2013) used a test of flexibility and grade point average, finding that flexibility explained 4.5% of academic achievement. For Hmelo-Silver (2004), these components or cognitive characteristics of creativity have an important role in students' learning process.

Contrary to the data obtained in this study, there are investigations that find no significant relationship between creativity and academic achievement in university students. Using university admissions test score for academic achievement, Zabelina, Condon and Beeman (2014) found no significant relationship between creativity and academic achievement (r=.19). Other studies (Elisondo, Chiecher & Paoloni, 2018; Ibrahim, 2012; Lovelace & Hunter, 2013) used grade point average from school subjects to estimate academic achievement, and likewise found no significant relationship between creativity and academic achievement. In these research studies, regardless of the measure used to estimate academic achievement, the magnitude of the relationship remains low. Moreover, our own results reveal a lack of significant relationship between academic achievement and the graphic or visual dimension of creativity and the test factors that comprise it: graphic originality, elaboration and details. This data tendency is consistent with results from a meta-analysis carried out by Gajda, Karwowski and Beghetto (2017), who found that academic achievement correlates more significantly with verbal creativity and its factors than with graphic or visual creativity and its factors.

As for the second research hypothesis concerning the capacity of creativity to predict academic achievement, it was also confirmed. The results obtained here indicate that creativity explained 9.7% of the admissions test score, implying that students with higher scores in general creativity are those with better scores on the university admissions test. These results are in the same line as findings from Pérez-Fabello and Campos (2007), where creative experience predicted 9% of academic achievement in the subject of Drawing in university students of Fine Arts. Tatlah et al. (2012) found that creativity and emotional intelligence predicted 3% of academic achievement as measured by grade point average; and for Gajda, Karwowski and Beghetto (2017), creativity explained 5% of academic achievement as a result of their meta-analysis of 120 studies published since 1960.

In light of these results indicating that creativity is a low level predictor in academic achievement, it is important to consider what factors may be influencing the relationship between creativity and academic achievement. Some of these factors might be sample size, type of methodology used, and the tests chosen to measure the constructs of creativity and academic achievement. Regarding the measurement of academic achievement, we observed earlier that similar results were obtained regardless of the measure used. On the other hand, when measuring creativity, diverse measures have been used --self-report questionnaires, objective creativity tests and tests of divergent thinking-- which do not focus on the same factors or characteristics of creativity. In one study, Gajda, Karwowski and Beghetto (2017) found a stronger relationship between creativity and academic achievement when using creativity tests as opposed to self-reports. In the present study, the PIC-A test was used to estimate levels of general, narrative and graphic creativity of university students, in a sample which fell below levels found in other groups of university students (students of Pedagogy, Fine Arts, Advertising and Social Education). Even in comparison to the group of teacher training students of the PIC-A test, our sample places one standard deviation below. These data indicate the low level of creativity in the preservice teachers of our sample when they entered the university context as Education students, and the need to boost their creativity during their degree program, that they might improve their future employability skills and be able to teach creativity in the classroom.

In a study with university teachers, Alencar and Oliveira (2016) indicated that the teachers themselves stressed a need to improve student creativity; however, Cropley (2005) found that while teachers are in favor of promoting creativity in the classroom, they recognize that they are not doing so in their classroom practice. University teachers need to overcome certain barriers that limit their classroom work on creativity, such as a lack of resources and the type of student assessment (Lima & Alencar, 2014), implying changes in the culture and organization of the university.

In recent years, different empirical and theoretical studies in Education and Educational Psychology have focused their inquiry on a possible relationship between creativity and learning, operationalized as academic achievement. This phenomenon is generating contradictory results among researchers, due to the types of measures used in assessing the constructs and the variables that intervene in this relationship, as well as other factors. In this study, the evidence supports a relationship between general creativity level and academic achievement

as determined by the tests selected for measuring creativity and academic achievement, respectively. These results can serve for future exploration and comparisons that hypothesize possible explanatory theoretical models about the relationship between these constructs, for designing measures of academic achievement that better reflect the level of learning, and measures of creativity that incorporate the same characteristics of creative thinking. Such a change in measuring creativity and academic achievement may be able to reflect the relationship between students' creativity and their academic achievement with greater empirical accuracy.

Possible educational implications from the data can be applied to the functional and practical, addressing changes in how students are admitted to university, and changes in the university training of preservice school teachers. First, higher education should identify students' creativity and develop a university admissions procedure that evaluates general potential, including creativity and other cognitive processes. Second, during their university training, future teachers should undergo creative pedadogical practices and experiences that they can later teach in their own classrooms, in an environment that encourages the expression of creativity. Future teachers can be taught to use creative strategies/techniques that motivate students and gamified activities that promote meaningful learning and foster creativity. This creative experience in university training also constitutes a foundation in innovation and research that improves graduates' employability and prepares them to contribute to the knowledge that society needs in different contexts.

In concluding, we would mention that sample size is the main limitation of this study, so generalization to other populations must be done with caution. In future studies it would be advisable to use a larger sample; to select other years of study and other universities, analyzing whether the results obtained in this study are replicated in academic achievement in other academic subjects; and to carry out a longitudinal study with the research sample.

References

Alencar, E. M. & Oliveira, Z. M. (2016). Creativity in higher education according to graduate programs' professors. *Universal Journal of Educational Research, 4*(3), 555-560. https://doi.org/10.13189/ujer.2016.040312

Alexander, P. A., Schallert, D. & Reynolds, R. E. (2009). What is learning anyway? A topographical perspective considered. *Educational Psychologist, 44*, 176-192. https://doi.org/10.1080/00461520903029006

Aljughaiman, A. & Mowrer-Reynolds, E. (2005). Teacher's conceptions of creativity and creative students. *The Journal of Creative Behavior, 39*, 17-37. https://doi.org/10.1001/j.2162-6057.2005.tb01247.x

Artola, T., Barraca, J., Mosteiro, P., Ancillo, I., Poveda, B. & Sánchez, N. (2012). *Prueba de Imaginación Creativa – Adultos (PIC-A)*. [Test of Creative Imagination --Adults *(PIC-A)*] Madrid: TEA Ediciones.

Balgiu, B. & Adîr, V. (2014). Creativity tasks and academic achievement. A study on Romanian Politehnica Undergraduate Students. *Procedia –Social and Behavioral Sciences, 116*, 924-928.

Berghetto, R. A. (2016). Creative learning: A fresh look. *Journal of Cognitive Education and Psychology, 15*, 6-23. https://doi.org/10.1891/1945-8959.15.1.6

Campos, A. & González, M. A. (1994). ¿Es la creatividad un factor determinante en los estudios de Bellas Artes? [Is creativity a determining factor in Fine Arts studies?] *Revista Galega de Psicopedagoxía, 8-9*, 209-217.

Castaño, R., Jenaro, C. & Florez, N. (2013). *Prácticas docentes favorecedoras de la creatividad en educación infantil y primaria: importancia y utilización*. [Teaching practices to encourage creativity in early childhood and primary education: importance and use.] Paper presented at the II International Congress on Learning, Innovation and Competitiveness, Madrid, Spain.

Chamorro-Premuzic, T. (2006). Creativity versus conscientiousness: Which is a better predictor of student performance? *Applied Cognitive Psychology, 20*, 521-531.

Cheung, C., Rudowicz, E., Yue, X. & Kwan, A.S.F. (2003). Creativity of university students: What is the impact of field and year of study? *The Journal of Creative Behavior, 37*, 42-63.

Chooi, W., Long, H. E. & Thompson, L. A. (2014). The Sternberg Triarchic Abilities Test (Level-H) is a measure of g. *Intelligence, 2*, 56-76. https://doi.org/10.1207/S15326934CRJ1334_11

Colca Ccahuana, G. J. (2016). *Pensamiento creativo y rendimiento académico de los estudiantes de Maestría, en la sede Lima Norte de la Universidad Nacional de Educación Enrique Guzmán y Valle, 2011.* [Creative thinking and academic achievement in Master's degree students at the North Lima campus of *Enrique Guzmán y Valle* National Teacher Training University, 2011.] (Final project). Universidad Nacional de Educación Enrique Guzmán y Valle, Peru.

Cropley, A. J. (2005). *Creativity in education & learning.* London: Routledge.

Day, L., Hanson, K., Maltby, J., Proctor, C. & Wood, A. (2010). Hope uniquely predicts objective academic achievement above intelligence, personality and previous academic achievement. *Journal of Research in Personality, 44*, 550-553. https://doi.org/10.1016/j.jrp.2010.05.009

De la Torre, S. (1996). *Para investigar la creatividad.* [Researching creativity.] DOE: Barcelona.

Dollinger, S. J. (2011). Standardized minds or individuality? Admissions tests and creativity revisited. *Psychology of Aesthetics, Creativity and the Arts 5*, 329-341.

Elisondo, R. C., Chiecher, A. C. & Paoloni, P. V. R. (2018). Creatividad, ocio y rendimiento académico en estudiantes de ingeniería. [Creativity, leisure and academic achievement in Engineering students.] *Reidocrea, 7*, 28-42.

Gajda, A., Karwowski, M. & Beghetto, R. A. (2017). Creativity and academic achievement: A meta-analysis. *Journal of Educational Psychology, 109*(2), 269-299.

González Barbera, C., Caso Niebla, J., Díaz López, K. & López Ortega, M. (2012). Rendimiento académico y factores asociados. Aportaciones de algunas evaluaciones a gran escala. [Academic achievement and associated factors. Contributions from some large-scale assessments.] *Bordón, 64*(2), 51-68.

Hirsh, J. B. & Peterson, J. B. (2008). Predicting creativity and academic success with a fake-proof measure of the Big Five. *Journal of Research in Personality, 42*, 1323-1333. https://doi.org/10.1016/j.jrp.2008.04.006

Hmelo-Silver, C. E. (2004). Problem-based learning: what and how do students learn? *Educational Psychology Review, 16*, 235-266.

Hosseini, A. S. (2011). University student's evaluation of creative education in universities and their impact on their learning. *Procedia Social and Behavioral Sciences, 15*, 1806-1812.

Ibrahim, B. (2012). *Exploring the relationships among creativity, engineering knowledge and design team interaction on senior engineering design projects* (Unpublished doctoral dissertation). Fort Collins: Colorado State University.

Klimenko, O. & Botero, A. (2016). Fomento de la capacidad creativa desde las prácticas de enseñanza en una institución universitaria. [Fostering creative ability through teaching practices at a university institution.] *Revista de Psicoespacios, 10*(17), 71-93.

Klimenko, O. & Botero, A. (2017). Concepciones de algunos docentes universitarios al respecto de la articulación de la creatividad en sus prácticas de enseñanza. [Some university teachers' conceptions on incorporating creativity into their teaching practices.] *Revista Psicoespacios, 11*(18), 74-94.

Lima, V. B. & Alencar, E. M. (2014). Criatividades em programas de pos-graduaçao em educaçao: práticas pedagógicas e fatores inibidores. [Creativity in post-graduate Education programs: pedagogical practices and hindering factors.] *Revista Psico USF, 19*(1), 61-72.

Llor Zaragoza, L., Ferrándiz García, C., Ferrnado Prieto, M. & Fernández, M. C. (2013). Batería Aurora (inteligencia analítica y práctica) y rendimiento académico. [Aurora Battery (analytical and practical intelligence) and academic achievement.] *Revista de Psicologia, Educação e Cultura, XVII*(2), 49-65.

Lovelace, J. B. & Hunter, S. T. (2013). Charismatic, ideological and pragmatic leaders' influence on subordinate creative performance across the creative process. *Creative Research Journal, 25*, 59-74. https://doi.org/10.1080/10400419.2013.752228

Matthew, C. T. & Stemler, S. E. (2013). Assessing mental flexibility with a new word recognition test. *Personality and Individual Differences, 55*, 915-920. https://doi.org/10.1016/j.paid.2013.07.464

Naderi, H., Abdullah, R., Aizan, T., Sharir, J. & Kumar, V. (2009). Creativity, age and gender as predictors of academic achievement among undergraduate students. *Journal of American Science, 5*, 101-112.

Nami, Y., Marsooli, H. & Ashouri, M. (2014). The relationship between creativity and academic achievement. *Procedia-Social and Behavioral Sciences, 114*, 36-39.

Newton, D.P. & Newton, L.D. (2009). Some student teachers' conceptions of creativity in school science. *Research in Science and Technological Education, 21* (1), 45-60.

OECD (2016). *PISA 2015. Key results.* Paris: OECD Publishing. Retrieved from http://www.oecd.org/pisa/pisa-2015-results-in-focus-ESP.pdf

Ofili, P. (2011). *Do multicultural experiences and biculturalism promote creativity in international students?* (Unpublished master's thesis). Oxford: University of Mississippi.

Pérez-Fabello, M. J. & Campos, A. (2007). Creatividad y rendimiento académico de los estudiantes de Bellas Artes. [Creativity and academic achievement in Fine Arts students.] *Revista Galego-Portuguesa de Psicoloxía e Educacion, 15*(2), 127-133.

Pishghadam, R., Khodadady, E. & Zabihi, R. (2011). Learner creativity in foreign language achievement. *European Journal of Educational Studies, 3,* 465-472.

Pozo, J., Scheuer, N., Pérez, M., Mateos, M., Martín, E. & Cruz, M. de la (2006). *Nuevas formas de pensar la enseñanza y el aprendizaje. Las concepciones de profesores y alumno*s. [New ways to think about teaching and learning.] Barcelona: Grao.

Pretz, J. E. & Kaufman, J. C. (2015). Do traditional admission criteria reflect applicant creativity? *The Journal of Creative Behavior, 0(0),* 1-15. https://doi.org/10.1002/jocb.120

Sternberg, R. J. (2008). Increasing academic excellence and enhancing diversity are compatible goals. *Educational Policy, 22*, 487-514. https://doi.org/10.1177/089590487310037

Tatlah, I. A., Aslam, T. M., A. Z. & Iqbal, M. (2012). Role of intelligence and creativity in the achievement of students. *International Journal of Psychology and Counselling, 3*(2), 29-32.

Wang, A. Y. (2007). *Contexts of creative thinking: Teaching, learning and creativity in Taiwan and the United States* (Unpublished doctoral dissertation). Claremont, CA: Claremont Graduate University.

Zabelina, D. L., Condon, D. & Beeman, M. (2014). Do dimensional psychopathology measures relate to creative achievement or divergent thinking? *Frontiers in Psychology, 5*, 1029.

Cristina de la Peña Álvarez