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Mental imagery skills among students of Architecture, Fine Arts and Psychology

Habilidades de imagen mental en estudiantes de Arquitectura, Bellas Artes y Psicología

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Abstract

Mental imagery skills play a fundamental role in numerous learning processes and in the development of competencies associated with different academic and professional fields. This study examined differences in image vividness, image control, mental rotation, and spatial imagery among university students enrolled in Architecture, Fine Arts, and Psychology programs. A total of 240 students took part, completing standardized measures of image vividness, image control, mental rotation, and spatial imagery. Unlike previous research, participants were categorized according to whether they exhibited high or low levels of each skill, which allowed for a more precise examination of performance profiles across academic disciplines. The results showed that Architecture students displayed consistent advantages in several mental imagery skills, particularly in spatial imagery and mental rotation. Moreover, among participants with high imagery abilities, Architecture students excelled in vividness and control of imagery compared to those studying Fine Arts and Psychology. In contrast, differences were less pronounced among participants with lower levels of certain skills. These findings suggest that the specific learning demands of certain academic programs may be associated with differences in the development of mental imagery skills, and highlight the importance of taking these abilities into account in educational and academic guidance contexts.

Keywords: mental imagery; mental rotation; spatial imagery; visuospatial skills; university students.

Resumen

Las habilidades de imagen mental desempeñan un papel fundamental en numerosos procesos de aprendizaje y en el desarrollo de competencias vinculadas a diferentes ámbitos académicos y profesionales. Este estudio analizó las diferencias en viveza de imagen, control de imagen, rotación mental y capacidad de imagen espacial en alumnado universitario de Arquitectura, Bellas Artes y Psicología. Participaron 240 estudiantes, que completaron pruebas estandarizadas de viveza de imagen, control de imagen, rotación mental e imagen espacial. A diferencia de investigaciones previas, los y las participantes fueron clasificados/as según presentaran niveles altos o bajos en cada habilidad, lo que permitió examinar con mayor precisión los perfiles de rendimiento en cada titulación. Los resultados mostraron que el alumnado de Arquitectura obtuvo ventajas consistentes en varias competencias de imagen mental, especialmente en habilidades espaciales y de rotación mental. Además, entre quienes presentaban niveles elevados de capacidad imaginativa, los estudiantes de Arquitectura destacaron en viveza y control de imagen frente a los de Bellas Artes y Psicología. En cambio, las diferencias fueron menos acusadas en los grupos con niveles bajos de algunas habilidades. Estos hallazgos sugieren que las demandas formativas específicas de determinadas titulaciones pueden estar asociadas al desarrollo diferencial de competencias de imagen mental y refuerzan la importancia de considerar estas capacidades en los contextos educativos y de orientación académica.

Palabras clave: imagen mental; rotación mental; imagen espacial; habilidades visoespaciales; alumnado universitario.

Introduction

Spatial imagery is a particular type of mental imagery. Kosslyn and Koenig (1992) and Kosslyn (1994) have shown that there are two types of mental imagery: spatial imagery and object imagery. Object imagery refers to characteristics of objects, such as shape, colour, size, texture, etc., whereas spatial imagery focuses on moving objects, object rotation, relationships between objects, spatial transformations, etc. (Blajenkova et al., 2006; Blazhenkova & Kozhevnikov, 2009). Further, spatial imagery can refer to unrotated images or it may require rotation (Campos, 2009, 2012, 2013; Vandenberg & Kuse, 1978). Unrotated spatial images are images in which objects are either in space or in motion, but never require rotation. Rotated images, on the other hand, imply generation of spatial images and then rotation (Campos, 2012).

Several studies indicate that mental imagery, especially spatial processing, plays a capital role at all levels of education (Commodari et al., 2024; Fastame, 2021; Guarnera et al., 2019). STEM university degrees (Science, Technology, Engineering and Mathematics) are known to be strongly related to spatial imagery (Campos & Campos-Juanatey, 2019a, 2019b; Campos-Juanatey et al., 2026; Pérez-Fabello et al., 2018), whereas object imagery is more implicated in other university degrees, such as Fine Arts (Campos-Juanatey et al., 2026; Pérez-Fabello et al., 2018). Architects, mathematicians and scientists (STEM students) predominantly tend to use spatial imagery more often than other professionals, which would explain why they obtain better results in spatial imagery tests (Alonso & Campos, 2013; Blajenkova et al., 2006; Kozhevnikov et al., 2002, 2010). It has been argued that good architects have higher performance in spatial imagery than bad architects (Alias et al. 2002; Mataix et al., 2014; Mohler & Miller, 2008).

Pérez-Fabello et al. (2018) wanted to investigate whether there were differences in imagery skills between students of Engineering, Fine Arts, and Psychology. To that end, they used several tests, namely the Spanish version (Campos & Pérez-Fabello, 2011) of the Object-Spatial Imagery and Verbal Questionnaire (OSIVQ; Blazhenkova & Kozhevnikov, 2009), the Mental Rotation Test (MRT; Vandenberg & Kuse, 1978), and the Measure of the Ability to Form Spatial Mental Imagery (MASMI; Campos, 2009, 2013). The OSIVQ measures object imagery, spatial imagery, and verbal processing. The MRT is a performance test that measures image rotation. And the MASMI is a performance test that measures spatial imagery. It was found that Fine Arts students obtained better scores on the object image scale than Engineering students, and Psychology students obtained better scores on the said scale than Engineering students, but no significant differences were spotted between Fine Arts and Psychology students. Engineering students had higher scores on the spatial image

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scale than Fine Arts and Psychology students, and Fine Arts students had higher spatial scores than Psychology students. Finally, Psychology students had higher scores on the verbal scale than Fine Arts and Engineering students.

Pérez-Fabello et al. (2018) also found that the type of degree influenced image rotation measured through the MRT. Engineering students had higher scores than Fine Arts and Psychology students, and Fine Arts students had higher scores than Psychology students. They also established that Engineering students had higher scores on the MASMI than Fine Arts and Psychology students. No significant differences were found between Fine Arts and Psychology students in the MASMI scores.

Campos and Campos-Juanatey (2019a) analysed whether there were differences in map rotation between university students of Architecture, Fine Arts, Psychology, and Business Administration. The authors used 90 pairs of real-life city maps which were presented to participants. For each pair, participants were asked to indicate whether the maps were identical or symmetrical. To be able to provide an answer, participants had to mentally rotate one of the maps. Results indicated that Architecture students obtained significantly higher scores on map rotation than Business Administration and Psychology students whereas Fine Arts students obtained significantly higher scores than Business Administration and Psychology students. No significant differences were found between the scores obtained by Fine Arts and Architecture students.

Recently, Campos-Juanatey et al. (2026) sought to determine whether there were significant differences in mental imagery between university students of Architecture, Fine Arts, and Psychology. In order to do so, they administered tests that measured image control (Gordon Test), image vividness (VVIQ), spatial imagery (MASMI), and image rotation (MRT). They found no significant differences between degrees in image control or image vividness. However, they found that Architecture students scored higher on spatial imagery than Fine Arts and Psychology students, and also that Architecture students scored higher on image rotation than Psychology students.

Some authors state that differences in mental imagery among students from diverse academic degrees or professions depend on the fact that mental imagery be, or be not, commonly used in those academic degrees or professions (Kozhevnikov et al., 2005, 2010; Liben et al., 1981; Motes et al., 2008). Campos and Campos-Juanatey (2019b), for example, demonstrated that both Architecture and Fine Arts students tend to have routinized mental imagery, while Psychology and Business Studies students do not (Campos & Campos-Juanatey, 2019b).

High spatial skills are key to many professions to the extent that work performance would be hindered if they are not operating. Fortunately, however, these spatial skills can be trained at any point in life (Hyde & Lindberg, 2007; Mataix et al., 2014, 2015). Some

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authors, such as Uttal et al., 2013, go as far as to state that many more people would choose STEM-related careers provided that spatial skills training were included in pre-university education levels.

As seen previously, research on mental imagery involving students from a number of university programs, which primarily compared STEM and non-STEM programs, used to be based on direct test scores. Thus, no difference can be drawn between students high and low in mental imagery, that is, there exists no comparison of those with high scores on some tests with those with high scores on others. Our aim was to determine whether there was a significant difference between students from Architecture, Psychology, and Fine Arts on different mental imagery tests when they had high scores on those tests. So we aimed to determine whether there was a significant difference between university students in Architecture, Psychology, and Fine Arts on different mental imagery tests when they had low scores on those tests. We also wanted to know if there was a significant difference between students of the three fields of study in various mental imagery tests when they had low scores on those tests. Our hypothesis states that there is a significant difference between students in Architecture, Psychology, and Fine Arts when they have high mental imagery skills. We also hypothesized that there is a significant difference between students in Architecture, Psychology, and Fine Arts when they have low mental imagery skills. The independent variable is degree and the dependent variable is score on the four imagery tests.

Method

Participants

A group of 240 university students (120 women and 120 men) with a mean age of 20.07 years (*SD* = 3.00) and an age range between 18 and 25 participated in this research. 80 students (40 men and 40 women) were enrolled in the Fine Arts program at the University of Vigo; 80 (40 women and 40 men) were enrolled in the Psychology program at the University of Santiago de Compostela; and the last 80 (40 women and 40 men) were enrolled in the Architecture program at the University of A Coruña.

Instruments

We used the Spanish version (Campos et al., 2002) of the Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973). It consists of 16 items that are scored twice, once with eyes opened and then with eyes closed. Each item is scored on a scale ranging from 1, indicating: "Image perfectly clear and as vivid as a real experience," to 5, indicating: "There is no image; you only know what you are thinking about the object." Therefore, high scores

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indicate low image vividness, and vice versa. There is no time limit. Campos et al. (2002) found a Cronbach's alpha of .88. In our study, we obtained a Cronbach's alpha of .93.

The second questionnaire was the Spanish version (Pérez-Fabello & Campos, 2004) of the Gordon Test of Visual Imagery Control (Gordon Test; Richardson, 1969), which consists of 12 items about a car in different positions and different colours. Each item is a question with three possible answers: No = 0 points, Unsure = 1 point, or Yes = 2 points. Pérez-Fabello and Campos (2004) found a Cronbach's alpha of .69. In our research, we obtained an alpha of .77.

The Mental Rotation Test (MRT; Vandenberg & Kuse, 1978) is a picture rotation test consisting of 10 items, each being a three-dimensional geometric figure made up of small cubes. Each item consists of a criterion figure and two correct and two incorrect answers. Participants must rotate the figures to determine whether they match the criterion figure. Vandenberg and Kuse recommend that for correctness, two points be awarded if both answers to each item are correct and zero for any other answer. If only one answer is given and it is correct, it will be scored with one point. Participants are given three minutes to complete the Vandenberg and Kuse test. In our research, we found a Cronbach's alpha of .78.

Finally, we used the Measure of the Ability to Form Spatial Mental Imagery (MASMI; Campos, 2009, 2013), which consists of a decomposed cube that participants must mentally assemble to be able to answer 23 questions. Each question has four possible answers: two are true and two are false. The total test score is obtained by adding the correct answers and then subtracting the incorrect ones within a range value of 46 to -46. Campos (2009) obtained a Cronbach's alpha of .93. In our research, we obtained an alpha of .91.

Procedure

In small groups, participants were randomly asked to complete the following tests: the Spanish version of the Gordon Test of Visual Imagery Control (Gordon Test; Richardson, 1969), the Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973), the Measure of the Ability to Form Spatial Mental Imagery (MASMI; Campos, 2009, 2013), and the Mental Rotation Test (MRT; Vandenberg & Kuse, 1978).

The researchers read the test instructions aloud and the time spent on each of the timed tests was monitored. The research was conducted in compliance with the 2013 Declaration of Helsinki and was approved by the Ethics Committee of the University of Santiago de Compostela. All subjects participated voluntarily in this study after written informed consent was obtained.

Once the tests were assessed, we found the mean and standard deviation for each group of participants—Architecture, Fine Arts, and Psychology—on each test: VVIQ, Gordon Test, MRT, and MASMI (see Table 1). Participants who scored higher than their group mean

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on a test were considered "high in image." Participants who scored lower than their group mean on a test were considered "low in image".

Table 1

Means and standard deviations of VVIQ, Gordon, MRT, and MASMI scores obtained by students of Psychology, Fine Arts, and Architecture.

	Tests							
	VVIQ		Gordon		MRT		MASMI	
Degree	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Psychology	2.14*	0.62	20.91	2.95	7.70	4.89	7.61	8.80
Fine Arts	2.06*	0.54	21.51	2.91	10.43	4.93	11.31	6.99
Architecture	2.06*	0.75	21.58	3.25	11.11	4.85	20.21	13.19

* High scores on the VVIQ indicate low image vividness and vice versa.

Data analysis

Statistical analyses were performed using IBM SPSS Statistics, Version 25.0, statistical software (IBM Corporation, Armonk, NY, USA). A Cronbach's alpha was obtained to determine the reliability of each test.

First, all participants with scores above the mean were selected. Those high in vividness had high vividness on the VVIQ (low test score), those high in image control had high scores on the Gordon Test, those high in image rotation ability had high scores on the MRT, and those high in spatial imagery had high scores on the MASMI.

To determine whether there was a difference in image vividness (VVIQ) between the scores of students high in image vividness from the three university programs (Architecture, Fine Arts, and Psychology), we performed a 3-way Analysis of Variance (ANOVA) (degree). The independent variable is degree, and the dependent variable is the VVIQ score. Post hoc analyses were performed using the Least Significant Difference (LSD) method. We also performed three additional ANOVAs: one group had Gordon Test scores as dependent variable, a second group had MRT scores as dependent variable, and finally, the third group had MASMI scores as dependent variable. We also performed the same ANOVAs (four ANOVAs) as previously performed, but with participants (Architecture, Fine Arts, and Psychology) whose scores were lower than the mean for each group.

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Results

Participants with high image scores

An ANOVA was performed to determine whether there was a difference in vivid imagery ability (VVIQ) between the three groups of students (Architecture, Fine Arts, and Psychology) with low scores on the test (high imagery vividness). The groups' means and standard deviations are shown in Table 2. We found that there were significant differences in vivid imagery ability between students based on their field of study (Architecture, Fine Arts, and Psychology), $F(2, 125) = 5.03$, $p = .008$, $\eta p^2 = .08$. The LSD analysis indicated that Architecture students had higher imagery vividness (lower scores) than Psychology students ($p = .02$) and Fine Arts students ($p = .003$).

Table 2

Means and standard deviations of high scores on the Gordon, MRT, MASMI, and low scores on the VVIQ (High Vividness) obtained by students of Psychology, Fine Arts and Architecture.

	Tests							
	VVIQ		Gordon		MRT		MASMI	
Degree	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Psychology	1.65*	0.26	22.82	1.21	11.63	3.64	15.58	8.33
Fine Arts	1.69*	0.26	23.55	0.70	14.30	2.76	16.54	5.01
Architecture	1.50*	0.33	23.43	0.72	15.05	2.66	31.84	6.44
Total	1.62*	0.29	23.26	0.95	13.67	3.36	21.45	9.95

* High scores on the VVIQ indicate low image vividness and vice versa.

To determine whether there was a difference in image control ability (Gordon Test) between students with high scores on the Gordon Test from the three university programs (Architecture, Fine Arts, and Psychology), we performed an Analysis of Variance (ANOVA). The groups' means and standard deviations are shown in Table 2. We found that field of study influenced image control ability (Gordon Test), $F(2, 144) = 9.02$, $p < .001$, $\eta p^2 = .11$, power = .97. The LSD analysis indicated not only that Architecture students had greater image control than Psychology students ($p < .001$), but also that Fine Arts students had greater image control than Psychology students ($p < .001$).

A new ANOVA was performed to determine whether there were differences between those high in the mental image rotation (MRT) skills from the three university degrees. The means and standard deviations are shown in Table 2. We found significant differences between the groups based on the field of studies, $F(2, 118) = 14.03$, $p < .001$, $\eta p^2 = .19$, power = 1. The analysis with the LSD method indicated that Architecture students had higher

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image rotation skills than Psychology students ($p < .001$), and Fine Arts students had higher image rotation skills than Psychology students ($p < .001$).

Finally, we performed an ANOVA to determine whether there were differences between those high in spatial imagery ability (MASMI) from the three university degrees. The means and standard deviations are shown in Table 2. We found that there was a significant difference in the MASMI scores between groups based on the field of studies (Architecture, Fine Arts, and Psychology), $F(2, 109) = 71.32$, $p < .001$, $\eta p^2 = .57$, power = 1. The LSD analysis indicated that Architecture students had greater spatial imagery ability than Fine Arts students ($p < .001$), and Psychology students ($p < .001$).

Participants with low image scores

We performed an ANOVA to find out if there was a difference in the ability to form vivid images (VVIQ) between the three groups (Architecture, Fine Arts and Psychology) of students with low image vividness, i.e., high scores on the test. The means and standard deviations of the groups are in Table 3. We found that there were no significant differences between students in the ability to form vivid images based on their field of studies (Architecture, Fine Arts and Psychology), $F(2, 109) = 0.15$, $p = .86$, $\eta p^2 = .01$, power = .07. Again, we performed an Analysis of Variance, ANOVA, to find out if there was a difference in the image control ability (Gordon Test) between students with low scores on the Gordon test from the three university degrees (Architecture, Fine Arts and Psychology). The means and standard deviations of the groups are in Table 3. We found that field of studies did not influence image control ability of students low in image control ability (Gordon Test), $F(2, 90) = 2.27$, $p = .11$, $\eta p^2 = .05$, power = .45.

Table 3

Means and Standard Deviations of Low Scores on the VVIQ, Gordon, MRT, and MASMI, and High Scores on the VVIQ (Low Image Vividness), Obtained by Students of Psychology, Fine Arts, and Architecture.

	Tests							
	VVIQ		Gordon		MRT		MASMI	
Degree	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Psychology	2.63*	0.46	17.90	2.30	3.78	1.87	2.02	2.67
Fine Arts	2.58*	0.36	19.03	2.65	6.55	3.29	5.80	5.81
Architecture	2.64*	0.62	17.73	3.09	6.97	2.66	9.69	7.67
Total	2.62*	0.49	18.29	2.71	5.76	3.01	5.69	6.02

* High scores on the VVIQ indicate low image vividness and vice versa.

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We performed an ANOVA in order to determine whether there were differences between the three groups (Architecture, Fine Arts, and Psychology) of students low in mental image rotation (MRT) skills. Means and standard deviations are shown in Table 3. We found a significant difference between groups based on their field of study, $F(2, 116) = 16.82$, $p < .001$, $\eta p^2 = .23$, power = 1. The LSD analysis indicated that Architecture students low in image rotation skills had significantly better rotation skills than Psychology students ($p < .001$) while Fine Arts students low in image rotation had better image rotation skills than Psychology students low in rotation ($p < .001$).

Finally, a last ANOVA was performed to determine whether there were significant differences in spatial imagery (MASMI) between Architecture, Fine Arts, and Psychology students who were low in spatial imagery skills (MASMI). The means and standard deviations of the groups are shown in Table 3. We found that there were differences between groups based on the field of studies, $F(2, 125) = 24.77$, $p < .001$, $\eta p^2 = .28$, power = 1. The LSD analysis indicated that Architecture students low in spatial imagery skills had significantly better spatial skills than Fine Arts ($p < .001$) and Psychology students ($p < .001$); and Fine Arts students low in spatial skills had better spatial skills than Psychology students low in the said skills ($p < .001$).

Discussion

In this research, we sought to determine whether there were significant differences in image vividness, image control, spatial image, and image rotation among undergraduate students of Architecture, Fine Arts, and Psychology who were high in the said four skills. We also performed the same analyses with subjects low in those skills. First, we performed Cronbach's alpha analyses to assess the reliability of the measures. The Cronbach's alpha for the tests ranged from .77, obtained by the Gordon Test, to .93, obtained by the VVIQ, which indicates, according to Doval et al. (2023), an acceptable level of reliability.

Participants with high image scores

We found that Architecture students who were high in image vividness had higher image vividness than Psychology and Fine Arts students high in vividness. These results contradict previous ones, but it must be noted that earlier studies did not compare the results of individuals high in vividness among each other, they rather analysed the differences between degrees using total test scores. Pérez-Fabello et al. (2018) found that Fine Arts students obtained better scores in object image than Engineering students while Psychology students obtained better scores in object image than Engineering students, but there were no significant differences between Fine Arts and Psychology students. For their part, Campos-Juanatey et al. (2026) found no difference in image vividness between students

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of the Architecture, Fine Arts, and Psychology degrees. No previous study has reported on the Architecture students' superiority in image vividness.

Architecture students who were high in image control had greater image control than Fine Arts and Psychology students high in the said skill. These results contradict those obtained by Campos-Juanatey et al. (2026), who found no significant differences. It also contradicts the results of other authors, such as Campos-Juanatey et al., (2026) or Pérez-Fabello et al. (2018), who found that Fine Arts students are more closely related to object image and image control. No author found that Architecture students had higher results in image control than Fine Arts or Psychology students.

Architecture students with high image rotation had greater rotation skills than students from the Psychology degree program who were high in image rotation. This result coincides with that obtained by Pérez-Fabello et al. (2018), who also found that the type of degree influenced image rotation, as measured by the MRT. Engineering students scored higher than Fine Arts and Psychology students. Our results also parallel the study by Campos and Campos-Juanatey (2019a), who sought to determine whether there was a difference in map rotation between undergraduate students of Fine Arts, Psychology, Architecture, and Business Administration. They found that Architecture students obtained higher scores than Business Administration and Psychology students. This result also coincides with that obtained by Campos-Juanatey et al. (2026). So presumably, regarding image rotation, the same result is obtained either when using only individuals high in rotation or when using all individuals, that is, with no distinction between high and low.

Architecture students high in spatial imagery had greater spatial ability than students high in spatial imagery ability from the Fine Arts and Psychology university programs. This result is similar to that obtained by Pérez-Fabello et al. (2018) and Campos-Juanatey et al. (2026), who found that Architecture students had higher scores in spatial imagery (MASMI) than Fine Arts and Psychology students. This also confirms studies indicating that STEM students tend to use spatial imagery more often than other non-STEM students (Alonso & Campos, 2013; Blajenkova et al., 2006; Kozhevnikov et al., 2002, 2010). Results also concur with studies that call attention to the importance of spatial images for architecture professionals (Alias et al. 2002; Mataix et al., 2014; Mohler & Miller, 2008).

Participants with low image scores

No significant differences in image vividness were found between participants from Architecture, Fine Arts, and Psychology who were low in image vividness. This result contradicts the results obtained in this research for participants high in image vividness, as well as the results by Pérez-Fabello et al. (2018), who found significant differences in favour of Fine Arts students. It also supports the studies of Campos-Juanatey et al. (2026), although

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they used the total test scores and were not restricted to those low in image vividness, as we did.

No significant difference was found in image control among participants low in image control from the three university degrees. This result is consistent with the study by Campos-Juanatey et al. (2026) but contradicts the result we obtained, which indicated that there is no significant difference between students of Architecture, Fine Arts, and Psychology when they are low in image control.

Architecture students low in the image rotation ability had significantly greater image rotation ability than Psychology students. This result for Architecture students low in the said skill also coincides with the results we obtained for Architecture students high in the skill. Therefore, it can be assumed that, in the case of image rotation, a segregation between those high and low exerts no influence on results.

Finally, those Architecture students who were low in their ability to use spatial images had better spatial skills than Fine Arts and Psychology students. This result for students low in spatial imagery is similar to that found in this research for students high in the said ability and it also parallels previous studies (Alonso & Campos, 2013; Blajenkova et al., 2006; Campos-Juanatey et al., 2026; Kozhevnikov et al., 2002, 2010; Pérez-Fabello et al., 2018), although, none of the preceding work separately analysed the results of participants high and low in mental image rotation.

Some authors (Kozhevnikov et al., 2005, 2010; Liben et al., 1981; Motes et al. 2008) claim that differences in mental imagery between diverse academic degrees or professions are due to the fact that people have their own particular experiences with images, since each profession or degree demands different or even almost no images. For instance, Architecture and Fine Arts students have a day-to-day experience with mental images, albeit different ones. In contrast, Psychology or Business Administration students do not (Campos & Campos-Juanatey, 2019b).

Limitations of the study and future lines of research

Despite the fact that, in tasks such as image rotation, there are significant differences between women and men, this research has not addressed the matter of whether results occur in females or males.

This work focused on specific university degrees and particular tests. Future research will need to consider other university degrees and image tests as well as differences with regards to image between other professions.

To our knowledge, this research is the first ever to classify individuals from each profession and each image skill into high and low in order to later establish differences between those with high abilities and then between those with low abilities. We believe

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that assorting participants based on their image skills, as is being done recently when distinguishing between aphantasic and hyperphantasic individuals, is a highly productive line of research.

It is strongly recommended that professionals in the fields of Psychology and Education get to know each individual's image skills and understand the power of image in the learning process in order to guide students when making decisions relevant to their future professions. What is more, since image skills can be trained, education professionals are highly encouraged to schedule image training programs.

Conclusions

For the first time ever, it has been found that Architecture students high in image vividness have higher image vividness than Fine Arts and Psychology students high in the said skill.

It is also the first time that Architecture students high in image control have been found to have greater image control than Fine Arts and Psychology students (both those high and low in image control).

Architecture students, both high and low in image rotation ability, had higher image rotation scores than Psychology students.

Architecture students, both high and low in spatial imagery, had higher spatial imagery scores than Fine Arts and Psychology students (both those high and low in spatial imagery).

References

ALIAS, Maizam; BLACK, Thomas R.; & GRAY, David E. (2002). Effect of instructions on spatial visualisation ability in civil engineering students. *International Education Journal, 3*(1), 1-12.

ALONSO, María; & CAMPOS, Alfredo (2013). Las imágenes mentales de los estudiantes de ciencias y ciencias sociales [Mental imagery of science and social science students]. In Ramón González Cabanach, Ramón Fernández-Cervantes, Francisca Fariña, Manuel Vilariño, & Carlos Freire (Eds.), *Psicología y salud I: Educación, aprendizaje y salud* [Psychology and health I: Education, learning and health] (pp. 121-125). GEU.

BLAJENKOVA, Olessia; KOZHEVNIKOV, María; & MOTES, Michael A. (2006). Object-spatial imagery: A new self-report imagery questionnaire. *Applied Cognitive Psychology, 20*, 239-263. https://doi.org/10.1002/acp.1182

BLAZHENKOVA, Olessia; & KOZHEVNIKOV, Maria (2009). The new object-spatial-verbal cognitive style model: Theory and measurement. *Applied Cognitive Psychology, 23*, 638-663. https://doi.org/10.1002/acp.1473

CAMPOS, Alfredo (2009). Spatial imagery: A new measure of the visualization factor. *Imagination, Cognition and Personality, 29*, 31-39. https://doi.org/10.2190/IC.29.1.c

CAMPOS, Alfredo (2012). Measure of the ability to rotate mental images. *Psicothema, 24*(3), 431-434. https://doi.org/10.1037/t14408-000

CAMPOS, Alfredo (2013). Reliability and percentiles of a measure of spatial imagery. *Imagination, Cognition and Personality, 32*, 427-431. https://doi.org/10.2190/IC.32.4.f

CAMPOS, Alfredo; & CAMPOS-JUANATEY, Diego (2019a). Gender differences in the rotation of city maps. *American Journal of Psychology, 132*(3), 303-313. https://doi.org/10.5406/amerjpsyc.132.3.0303

CAMPOS, Alfredo; & CAMPOS-JUANATEY, Diego (2019b). Do gender, discipline, and mental rotation influence orientation on "You-Are-Here-Maps"? *SAGE Open*. 1-7. https://doi.org/10.1177/2158244019898800

CAMPOS, Alfredo; GONZÁLEZ, María A.; & AMOR, Angeles (2002). The Spanish version of the Vividness of Visual Imagery Questionnaire: Factor structure and internal consistency reliability. *Psychological Reports, 90*, 503-506. https://doi.org/10.2466/PR0.90.2.503-506

CAMPOS, Alfredo; & PÉREZ-FABELLO, Maria J. (2011). Factor structure of the Spanish Version of the Object-Spatial Imagery and Verbal Questionnaire. *Psychological Reports, 108*(2), 470-476. https://doi.org/10.2466/08.22.27.PRO.108.2.470-476

CAMPOS-JUANATEY, Diego; PÉREZ-FABELLO, Maria J.; & CAMPOS, Alfredo (2026). *Are there mental images characteristic of architecture students?* [Unpublished manuscript]. Department of Psychology. University of Santiago de Compostela.

COMMODARI, Elena; SOLE, Jasmine; GUARNERA, Maria; & LA ROSA, Valentina L. (2024). Mental imagery in education: What impact on the relationships with visuospatial processing and school performance in junior high school students? *Thinking Skills and Creativity, 54*, Article 101667. https://doi.org/10.1016/j.tsc.2024.101667

DOVAL, Eduardo; VILADRICH, Carme; & ANGULO-BRUNET, Ariadna (2023). Coefficient alpha: The resistance of a classic. *Psicothema, 35*(1), 5-20. https://doi.org/10.7334/psicothema2022.321

FASTAME, Maria C. (2021). Visuo-spatial mental imagery and geometry skills in school-aged children. *School Psychology International, 42*(3), 324-337. https://doi.org/10.1177/0143034321992458

GUARNERA, Maria; PELLERONE, Monica; COMMODARI, Elena; VALENTI, Giusse D.; & BUCCHERI, Stefania I. (2019). Mental images and school learning: A longitudinal study on children. *Frontiers in Psychology*, *10*, Article 2034. https://doi.org/10.3389/fpsyg.2019.02034

HYDE, Janet S.; & LINDBERG, Sara (2007). Facts and assumptions about the nature of gender differences and the implications for gender equity. In Susan S. Klein (Ed.), *Handbook for achieving gender equity through education* (pp. 19-32). Lawrence Erlbaum Associates.

KOSSLYN, Stephen M. (1994). *Image and brain: The resolution of the imagery debate*. MIT Press.

KOSSLYN, Stephen M.; & KOENIG, Olivier (1992). *Wet mind: The new cognitive neuroscience*. Free Press.

KOZHEVNIKOV, Maria; BLAZHENKOVA, Olessia; & BECKER, Michael (2010). Trade-off in object versus spatial visualization abilities: Restriction in the development of visual-processing resources. *Psychonomic Bulletin & Review, 17*, 29-35. https://doi.org/10.3758/PBR.17.1.29

KOZHEVNIKOV, Maria; HEGARTY, Mary; & MAYER, Richard E. (2002). Revising the visualizer-verbalizer dimension: Evidence for two types of visualizers. *Cognition and Instruction, 20*, 47-77. https://doi.org/10.1207/S1532690XCI2001_3

KOZHEVNIKOV, Maria; KOSSLYN, Stephen M.; & SHEPARD, Jennifer (2005). Spatial versus object visualizers: A new characterization of visual cognitive style. *Memory & Cognition, 33*(4), 710–726. https://doi.org/10.3758/BF03195337

LIBEN, Lynn S.; PATTERSON, Arthur H.; & NEWCOMBE, Nora (1981). *Spatial representation and behaviour across the life span: Theory and application*. Academic Press.

MARKS, David F. (1973). Visual imagery differences in the recall of pictures. *British Journal of Psychology, 64*, 17-24. https://doi.org/10.1111/j.2044-8295.1973.tb01322.x

MATAIX, Jesús; LEÓN, Carlos; & MONTES, Francisco P. (2014). Las habilidades espaciales de los estudiantes de las nuevas titulaciones técnicas. Un estudio en la Universidad de Granada [Spatial skills of students in new technical degrees. Case study at the University of Granada]. *EGA. Revista de Expresión Gráfica y Arquitectura, 24*, 264-271. https://doi.org/10.4995/ega.2014.1767

MATAIX, Jesús; LEÓN, Carlos; & REINOSO, Juan F. (2015). Métodos de entrenamiento de las habilidades espaciales de los estudiantes de titulaciones técnicas [Methods for training the spatial skills of students pursuing technical careers]. *EGA. Revista de Expresión Gráfica y Arquitectura, 26*, 278-287. https://doi.org/10.4995/ega.2015.3324

MOHLER, James L.; & MILLER, Craig L. (2008). Improving spatial ability with mentored sketching. *Engineering Design Graphics Journal, 72*, 19-27. https://core.ac.uk/download/pdf/229786357.pdf

MOTES, Michael A.; MALACH, Rafael; & KOZHEVNIKOV, Maria (2008). Object processing neural efficiency differentiates object from spatial visualizers. *Cognitive Neuroscience and Neuropsychology, 19*, 1727–1731. https://doi.org/10.1097/WNR.0b013e328317f3e2

PÉREZ-FABELLO, Maria J.; & CAMPOS, Alfredo (2004). Factor structure and internal consistency of the Spanish version of the Gordon Test of Visual Imagery Control. *Psychological Reports, 94*, 761-766. https://doi.org/10.2466/pr0.94.3.761-766

PÉREZ-FABELLO, Maria J.; CAMPOS, Alfredo; & FELISBERTI, Fatima M. (2018). Object-spatial imagery in Fine Arts, Psychology and Engineering. *Thinking Skills and Creativity, 27*, 131-138. https://doi.org/10.1016/j.tsc.2017.12.005

RICHARDSON, Alan (1969). *Mental imagery*. Springer.

UTTAL, David H.; MILLER, David I.; & NEWCOMBE, Nora S. (2013). Exploring and enhancing spatial thinking links to achievement in science, technology, engineering and mathematics? *Current Directions in Psychological Science, 22*, 367-373. https://doi.org/10.1177/0963721413484756

VANDENBERG, Steven G.; & KUSE, Allan R. (1978). Mental rotations, a group test of three-dimensional spatial visualization. *Perceptual and Motor Skills, 47*, 599-604. https://doi.org/10.2466/pms.1978.47.2.599

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