

EXPLORING THE RELATIONSHIP BETWEEN SELF-PERCEPTION OF SECURITY, CONFIDENCE, AND MOTIVATION WITH REPRESENTATION EXPERIENCE: A STUDY OBSERVING SPATIAL INTELLIGENCE

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ABSTRACT

Entry-level drawing abilities have significantly declined, a phenomenon that is largely due to the lack of observation of the principles and practices of teaching and learning new designers. This exploratory study examines the self-perceived security, confidence and motivation of design students who possess Spatial Intelligence (S.I.), by using three well-known brand markers, through three drawing activities (D.A.), students assessed their performance. Initial findings indicate positive effects on motivation, confidence and security aspects. Our study delves into S.I. possession, drawing experience, and global experience impact on exercises, revealing no statistical difference in motivation but significant disparities in confidence and security. Non-S.I. students exhibit higher confidence and security levels, indicating a correlation between emotional aspects, self-perception, and tool familiarity. The findings open new avenues for investigation on how to approach the student profile, the choice of tools, and the teaching process to improve students' aspects in D.A. for design education (D.E.).

Keywords: Design education, representation, spatial intelligence, higher education, educational innovation

1 INTRODUCTION

Since the last decade, there has been a notorious decline in entry-level drawing skills, which is believed to be mainly due to the methods and principles used in teaching and learning [1]. Therefore, there is a generalized deceleration in the development and progress of the students' essential skills [2]. However, the D.E. transformation focused on several aspects, e.g., on thinking by drawing and making as an ordinary skill [3]. Academic progress has been changed, which has led to studying the relationship between executive functions, motivation or self-esteem, and self-efficacy, potentiating a notable connection between beliefs in their abilities and improved academic performance [4]. For our research and in D.E. is the ability to create representations using the most appropriate tools [5]. Representations are considered the results that come from the skills of drawing, sketching, and objective and subjective drawing [6]. However, there is a debate about the importance of traditional representation, as part of D.E. focuses more on understanding information from other perspectives [7]. Nevertheless, the value of representation through drawing or sketching should always be present in different disciplines [8, 9]. Thus, representations in any of their physical variants represent an essential component in D.E. or problem-solving education, whether from an engineering perspective [10] or a more humanistic approach [11]. In either scenario, representation is a vital competence; from an early age, any design student must undergo experimentation with any tool to experience the dynamics of expressing their ideas [12]. A particularity to emphasize is, that representation competence is linked to S.I. possessing this intelligence enables an advantage for those who have an affinity with creative disciplines as there is evidence that supports the relationship between intelligence and the performance of project design [13]. S.I. brings a range of skills favouring the stimulation of relevant solutions [14, 15]. Consequently, students improve their academic results and experience by *continuously* believing in their competencies and abilities [16], and it can even represent a factor of self-confidence and security [17].

2 PILOT STUDY

2.1 Objective

This research aims to explore the self-perceived security, confidence, and motivation of design students who possess S.I., through using different markers in multiple exercises that stimulate their representational skills.

2.2 Participants

This study was conducted within a group of 50 design students from Tecnológico de Monterrey, México. All students were informed of the tasks they were going to perform. All students reported having normal vision and no colour recognition problems. The group consisted of 39 women and 11 men. These include 26 with S.I. and 24 non-S.I. Additionally, the study examined the students' drawing experience, a crucial skill for designers; 25 reported having medium-level drawing experience, while 19 claimed low-level knowledge and six claimed high. All percentages can be seen in Figure 1.

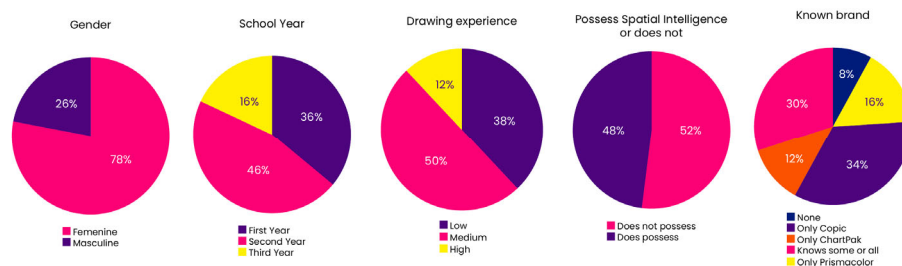


Figure 1. Graphs of participant data

2.3 Exercises

The core research is conducted by applying three exercises on a sheet of bond A3 paper (see Figure 2): (1) The first exercise is to identify the points of light and shadow in a three-dimensional object from an isometric perspective. A set of two solid shapes was placed in an isometric view with a sun icon for where to apply the light and shadows. Boxes must be filled with colour by given markers. (2) The second exercise is based on the basic principles of constructing an object, where students must devise an idea represented in detail based on a defined criterion. A creation of a representation of a mug, apply light and shadows to it, and preferably add a contrasting background with the given markers. (3) The third exercise was designed could raise preliminary ideas, develop a concept, and execute that idea to create a unique detailed proposal. Post-its guided the student to develop simple first ideas [18] and combine them later. Using these types of materials leads to the notion of pre-inventive structures, which focuses on internal "mental" representations, ensuring the externalization of the idea [19]. A chart divided into three sections to promote the creation of different proposals for the three parts of a lamp (the screen, body, and base) using only one marker and repeated with the other markers. Concluding the exercise, the students had to choose their favourite ideas and draw a new lamp using the best marker.

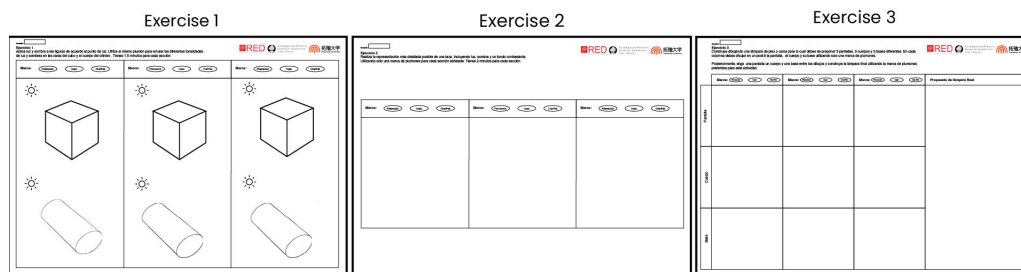


Figure 2. Exercises Sheets

2.4 Drawing tools

To conduct the exercises, we based our tool selections on similar studies [20, 21] that performed parallel research on D.A. In exercises aimed at enhancing four subject skills, utilizing traditional tools like markers improves conceptual outcomes in the initial design stages [22]. The given markers to each student were from the brands Chart pak© Spectra, Copic© Sketch, and Prismacolor© Premiere. To

ensure fairness and accuracy in our protocol process, we were provided colours and markers from each brand that were most similar in type and purpose (see Figure 3).



Figure 3. Photographs of the marker's lines

2.5 Implementation

The exercises were applied in a well-lit classroom. The protocol begins with welcoming and explaining the process and answering any doubts before moving on to the implementation. All data and question responses were collected in an online survey using Qualtrics® (www.qualtrics.com) via each student's cell phone. The exercises lasted 35 minutes; time was assigned to each section, and every 30 seconds, the time left was announced. When an exercise was concluded, students had to answer the questions related to the exercise conducted. These questions are used to explore the student's self-perception. The employed rating scale ranged from 1 to 5, with 1 representing the lowest and 5 signifying the highest value for markers' experience:

- How much has the marker helped you to carrying out the exercises?
- How much confidence has the marker given you?
- How much motivation has the marker given you?
- How much security has the marker given you?

Following the evaluation of the tools, three global questions about self-perception were asked using the same scoring system applied in the previous questions.

- According to the following definition (Motivation): Stimulate someone or awaken their interest. How motivated did you feel when carrying out all the exercises?
- According to the following definition (Confidence): Satisfied with himself. How confident did you feel carrying out all the exercises?
- According to the definition (Security): Said of a person - Who does not feel doubt. How secure did you feel carrying out all the exercises?

Finally, the protocol ended with a quiz on the user's intelligence based on Howard Gardner's Multiple Intelligence Theory [23]. The questions were taken from existing tests to determine the type of intelligence people possess. By eliminating the prompts where "no" was the answer to the question, the test would only consider the intelligences the students felt identified with. By summing up the yeses to their respective intelligence, the test determined which type of intelligence appeared the most. The whole protocol can be seen in Figure 4.



Figure 4. Scheme of the protocol process

3 DATA ANALYSIS AND RESULTS

The data analysis collected by the survey was divided into three parts of observations to detect all aspects considered during the exercise's execution with the markers. Statistical analysis was performed using SPSS 17.0 for Windows™ (IBM SPSS Inc., Chicago, IL, USA). The initial results are drawn from the self-perception questions after each exercise. Table 1 shows the rating for each exercise for each marking. In the same table, we can see the result of the three global questions of students' self-perception for motivation, confidence, and security.

Table 1. Descriptive statistics of all questions

	Exercise #1	Exercise #2	Exercise #3
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Questions (Qs)		Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Prismacolor	How much has the marker helped you to carrying out the exercises?	3.14	1.414	3.48	0.886	3.72	1.107
	How much confidence has the marker given you?	2.60	1.107	3.30	1.074	3.52	1.035
	How much motivation has the marker given you?	2.70	1.182	3.24	1.061	3.62	0.967
	How much security has the marker given you?	2.64	1.139	3.34	0.917	3.56	1.013
Copic	How much has the marker helped you to carrying out the exercises?	3.46	1.014	2.88	1.043	3.60	0.833
	How much confidence has the marker given you?	3.76	1.061	2.82	1.101	3.54	1.014
	How much motivation has the marker given you?	3.76	1.080	2.86	1.088	3.58	0.992
	How much security has the marker given you?	3.72	1.011	2.92	1.066	3.56	1.091
Chart-pak	How much has the marker helped you to carrying out the exercises?	3.42	1.108	3.50	0.953	3.30	1.111
	How much confidence has the marker given you?	3.30	1.074	3.74	0.853	3.22	1.148
	How much motivation has the marker given you?	3.34	1.154	3.58	0.785	3.20	1.107
	How much security has the marker given you?	3.40	1.195	3.54	0.862	3.14	1.212
Qs	How motivated did you feel when doing all the exercises?	Mean: 3.54			Std.Dev: 0.706		
	How confident did you feel performing all the exercises?	Mean: 3.08			Std.Dev: 0.778		
	How secure did you feel carrying out all the exercises?	Mean: 3.34			Std.Dev: 0.717		

The following result was made to observe the self-perception of the global questions segmented by drawing experience and S.I. possession. The data were verified to follow a normal distribution with a Kolmogorov test. A MANOVA test was performed to obtain the statistical differences of the students' answers. Table 2 shows the result of significant differences ($p < 0.05$) for the questions "How confident did you feel performing all the exercises? [F (4.329), $p=0.019$]" and "How secure did you feel doing all the exercises? [F (4.625), $p=0.015$]".

Table 2. Descriptive statistics and MANOVA results

Global questions	Drawing Experience	S.I. (not) possess	N	Mean	Std. Dev	F	Sig.
How motivated did you feel when doing all the exercises?	Low	Does not S.I.	10	3.20	0.789	0.622	0.541
		Possess S.I.	9	3.67	0.707		
	Medium	Does not S.I.	14	3.64	0.745		
		Possess S.I.	11	3.64	0.674		
	High	Does not S.I.	2	3.50	0.707		
		Possess S.I.	4	3.50	0.577		
How confident did you feel performing all the exercises?	Low	Does not S.I.	10	2.40	0.516	4.329	0.019
		Possess S.I.	9	3.33	1.000		
	Medium	Does not S.I.	14	3.36	0.633		
		Possess S.I.	11	3.09	0.701		
	High	Does not S.I.	2	3.50	0.707		
		Possess S.I.	4	3.00	0.816		
How secure did you feel doing all the exercises?	Low	Does not S.I.	10	2.80	0.789	4.652	0.015
		Possess S.I.	9	3.89	0.928		
	Medium	Does not S.I.	14	3.64	0.633		
		Possess S.I.	11	3.36	0.674		
	High	Does not S.I.	2	3.50	0.707		
		Possess S.I.	4	3.25	0.957		

4 DISCUSSIONS

This work is the beginning of a series of studies, where the drawing activity and the self-perception of the student's skills are at the center of the research development. This work focused on observing the development of the methodology to solve the stated objective. Some student exercises can be observed in Figure 5. The markers used were evaluated, where a positive evaluation was observed according to the exercise performed, regardless of the order of application. This finding marks the possible relevance of the tools according to the drawing activity performed. Inviting us to deepen in the perceptiveness of a tool and a drawing exercise.



Figure 5. Examples of the best (top) and the worst executed exercises (bottom)

The most striking results emerge from understanding the impact that S.I. possession, self-perception drawing experience, and global experience may have on the drawing exercises. In Table 2, the results reveal that for “motivation” there is no statistical difference between drawing experience and S.I. possession. However, the results reveal relevant information about “confidence” and “security”, where statistical differences were observed in the assessment. The findings reveal that students who do not possess S.I. for medium ($M_{np}=3.36$) and high ($M_{np}=3.50$) levels in drawing experience were more confident than those who possess S.I. at the same medium ($M_{po}=3.09$) and high ($M_{po}=3.0$) levels. The same effect is observed for the security of students who do not possess S.I. for medium ($M_{np}=3.64$) and high ($M_{np}=3.50$) levels, and those who possess S.I. at the same medium ($M_{po}=3.36$) and high ($M_{po}=3.25$) levels. These findings suggest a starting point of interest to understand how students self-perceive their abilities and emotional aspects when they execute a drawing practice with specialized tools. We can affirm that there is a close relationship between the emotional aspects of motivation, confidence, and security, their level of self-perception of their drawing experience, and familiarity with the tools, in our case the markers. Figure 6 shows all the aforementioned factors.

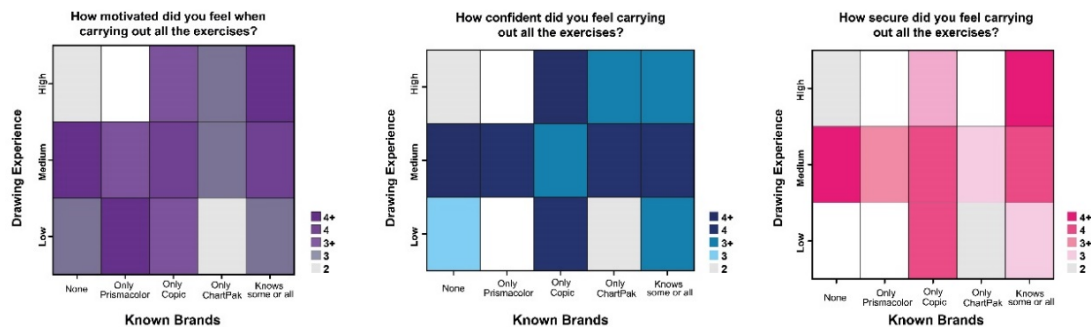


Figure 6. Assessment graphs for global experience, drawing experience, and tools knowledge

Limitations for this preliminary work are considered. In order to deepen the research, a larger sample will be enlarged, equating the students with the intelligences, and exploring aspects that influence their self-perception of emotional aspects related to drawing. An issue that was not addressed in this study was not include another representation tools like pencil or pen. In conclusion, this work provides an opening for further research on how to approach the student profile, the tools selection, and the teaching process to enhance motivation, confidence, and security to practice and learn drawing for D.E.

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