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ARCHITECTURE PRACTICAL LEARNING: ANALYSIS OF ARCHITECTURAL DESIGN STUDIO THROUGH A NEUROSCIENCE EDUCATION PERSPECTIVE

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During the Architecture and Urban Design IV studio (DAU IV), within the second year of the Architecture program (PUCE-FADA), the students most build and apply diverse construction systems in a project; we have noticed that manual knowledge is being lost. In the curricular design of architectural workshops most of the projects are based on digital media, yet analogical tools, like our own hands, could be vital to develop a broad experience in construction and a critical thinking. Due to this, the new curriculum has an emphasis in construction practice. Through a perspective of neuroscience education, this paper analyzes the program and the exercises developed during the studio. Some of the neuroscience pedagogic principles will evaluate the DAU IV studio: emotions and learning, real-life experiences, contextual learning and intrinsic motivation. The authors then critically review which of the activities developed are suitable and encouraging for addressing a practical learning. Recommendations will be outlined for future versions of the studio.

Keywords: Digital media, Real-life learning, Neuro-education, Learning through experience.

1 INTRODUCTION AND METHODOLOGY

This study analyzes the curriculum of studio DAU IV according to a neuroscience education perspective to determine if emphasizing practice and real-life experience is bringing the expected learning. Students in this year should be able to propose and build construction systems for a project located in an actual place. While at one hand, the use of digital media is increasing, at the other hand, practical skills and learning through experience is being left aside. Therefore, when facing real context, students may struggle generating critical thinking and proposing new approaches with available resources of a site. As Villacis Tapia and Ayarza (2020) mentioned, "Most of the environment where students develop is a comfort zone that is not aware nor in contact with reality. Neuroscience states that a multidisciplinary and holistic approach might create a better understanding". Therefore, as information technologies are rapidly arising and becoming essential, we could not deny that "emotional processes are required for the skills and knowledge acquired in school to transfer to novel situations and to real life" (Immordino-Yang and Damasio 2007). The aim of this paper is to, through some neuroscience principles, evaluate if the exercises proposed could potentially contribute to a long-term reflective learning rather than just approving a class. Throughout a theoretical basis about neuroscience and neuro-education principles, studio exercises

will be evaluated to ultimately define some strategies that can improve future design studio outcomes.

2 PRACTICAL SKILLS IN A DIGITAL ERA

2.1 Digital Media and the Gap with Reality

In an era where students are exposed to an "ocean of information on the electronic network" (Balfour 2001) and where "education prepares great technicians, who can collect beautiful images, but unlearn or never learn how to apply their bodily understanding of spaces to the creation of new experiences of place" (Nanda and Solovyova 2005). It is a fact that "technology is changing studio culture" (Balfour 2001).

"We have created a growing gap between the real world, with its rich, real experiences, deep understanding of matter, and the world of architectural education, with its mediated, mostly visual experiences." (Nanda and Solovyova 2005). We are facing the inevitable gap where stunning representations and the ultimate products have more importance than generating reflective thinking. However, design studio "often require students to be critical of, or explicitly subvert" (Balfour 2001). Therefore, it is imperative to ask, if as educators we are encouraging students enough to face new circumstances and become more proactive towards the real world.

2.2 Loss of Manual Knowledge

“It is a common lament that design students graduate without knowing which end to grasp a hammer or spade, and then proceed to lord it over construction workers who have vast stores of knowledge about such matters." (Sorvig 2005). Furthermore, "today, students rarely have first-hand experience; rather, their experience is disseminated through images in magazines, journals, books, the internet and television” (Lawson 2001). Lacking of first-hand experiences at school can become a limitation when professionals. Thus, teaching manual knowledge is much more than sharing practical tools is boosting autonomy and critical thinking when addressing new situations, it is encouraging students to be able to build by their own selves. "Are the professionals we train capable to adapt to the future?" (Villacis Tapia and Ayarza 2020).

2.3 Learning Through Experience

As Nanda and Solovyova (2005) state, "the whole aim of education shifted from gaining an understanding of ‘how it works, ‘learning to learn, and acquiring the minimum required skills, to gleaning as much information and as many skills in computer tools and current media as possible." is not that digital media does not contribute to education, is that as educators, we should provide experiential exercises in diverse context, with unfamiliar resources to motivate self-learning outcomes.

3 NEUROSCIENCE AND EDUCATION

Neuro-education, also known as the ‘science’ of learning, "encompasses a broad range of scientific disciplines, from basic neuroscience to cognitive psychology to computer science to social theory" (Jamaludin *et al.* 2019). As it helps to "create a broader understanding of how we achieve knowledge and how we manage information" (Villacis Tapia and Ayarza 2020), "its core is a resonant objective to determine and develop methods that teachers and students can use to improve the learning experience" (Jamaludin *et al.* 2019). Thinking about the future of the construction industry, the changing world and the contemporary needs, it is important that educators create new educational strategies and more effective teaching methods that adapt learning to diverse disciplines. Some key principles that integrate education with neuroscience will be developed

below. Then, these same principles, will be used to evaluate the exercises proposed in DAU IV curriculum.

- Emotions and learning: Emotions play an important role in learning process and memory consolidation, they "help to direct our reasoning into the sector of knowledge that is relevant to the current situation or problem" (Immordino-Yang and Damasio 2007). While positive experiences could direct to motivation, curiosity and engagement, negative emotions can provoke stress and emotions that wanted to be avoided. When thinking about the future professionals, we have to remember that "it is not only the quantity of information we received in the classroom, but the adequate way we apply it in the real world that makes that information becomes knowledge" (Villacis Tapia and Ayarza 2020), and, at the same time, that emotion brings reflective knowledge. It is then that exercises proposed during class might encourage meaningful memories that help students "decide when and how to apply what they have learned in school to the rest of their lives" (Immordino-Yang and Damasio 2007).
- Real-life experiences and contextual learning: Experiences found outside the classroom, in diverse context, can become significant learning that will help to assimilate real situations in the future. Furthermore, when information is presented in real-life context, learning integrates easily into the knowledge. According to Johnson (2002), "when students formulate projects or identify interesting problems, when they make choices and accept responsibility, search out information and reach conclusions, when they actively choose, order, organize, touch, plan, investigate, question, and make decisions to reach objectives, they connect academic content to the context of life's situations". Thus, formulating hands-on activities related with real context and daily life, can help students to develop the necessary skills to solve new problems.
- Intrinsic motivation: Motivation is stretchy related with emotional behaviors and pleasant feelings. As Ng (2018) states, positive experiences can strengthen the learner's intrinsic motivation in a particular subject and allow them to autonomously cope with unforeseen circumstances. It is important to recall that "motivation should be understood not only as a short (visceral desire) but as a long term (university or professional goals) approach" (Villacis Tapia and Ayarza 2020). Thus, proposing exercises that encourage motivation help to engage students not only with academic activities, but to perform future real-life projects.

4 DAU IV WORKSHOP (ARCHITECTURE AND URBAN DESIGN IV)

Architecture and Urban Design IV (DAU IV) is a second-year academic workshop of the Pontifical Catholic University of Ecuador in Quito at the School of Architecture, Design, and Art (PUCE-FADA). Its main goal is to understand architecture as the art of built within a real context. During this workshop, students experience three main stages: Expedition and site visit to a new city, practical wisdom and hands-on in new construction systems, project development.

- Expedition and site visit: During the first week, we visited Cuenca and its surroundings, a city located in the south region of Ecuador. The aim was to learn from new context through observing and capturing situations by pictures and drawings. Beyond just visiting architectural referents, we focus on discovering daily life situations, materials and historic layers that made this region unique. At the end of this trip, the deliverable was a drawing journal with a collection of personal discoveries.
- Practical wisdom and hands-on: Once we came back to school with all the findings, students proposed diverse tectonic postures and explored the complied materials to finally

built empirical construction systems. At this stage, those construction systems were based on what they experienced, rather than a replica of something they saw. All of this process was mainly developed in the FADA's carpentry, locksmith and 3D laboratory.

- Project development: After understanding the site by first-hand experience and by exploring it with a tectonic point of view, students developed an architectural project, which had to be coherent with the culture, the context and the users.

Previous workshops usually used to make a site visit first and move on directly to the development of the architectural project. We noticed that by moving directly to a product before having the chance to explore, students lose motivation after the first stage and they did not engage during the process. Consequently, students used to end the semester understanding this as another project, rather than earning meaningful learning and skills to intervene coherently in future sites. Furthermore, as the result was more directed to a product, students used to focus more in "gleaning as much information and as many skills in computer tools and current media as possible" (Nanda and Solovyova 2005), than understanding of 'how materials works' and learning to learn how to propose new systems.

Incorporating more experiential exercises, site visits to diverse context and hands-on in construction since the begging, are some of the actions fomented in DAU IV curriculum.

5 DAU IV WORKSHOP AND NEUROSCIENCE

Here the DAU IV stages are evaluated through the neuroscience principles:

- Site visit was the first real-life activity; students faced a contextual learning since the first week. They were able to connect the meaning of the studio with the context, which also means, "the broader the context within which students are able to make connections, the more meaning content will hold for them (Johnson 2002).
- This first experience evoked positive emotions, thus motivation. From around the fifty students that went to the site visit, the bulk reached the goal satisfactorily. They actively investigated, made decisions and portray their personal discoveries. At the end of the week, around fifty personal journals were display in Cuenca's downtown public staircase.
- Hands-on was the second real-life experience, students spent around four weeks testing and exploring tectonic postures within class and the laboratories. When they have to "psychically build, all of the senses are included, the body as a whole is included and the knowledge has to be multidisciplinary" (Villacis Tapia and Ayarza 2020). Senses evoke emotions, and emotions awake motivation.
- Materializing the findings made at the site visit, triggered engagement and motivation with the process. The results of this stage were unexpected even for the professors; many students came with non-conventional construction systems. This experience is expected to allow them to apply the gained knowledge in the future, "as when we are asked to do something we have not done before, immediately we try to recall whether we have experienced anything similar" (Johnson 2002).
- Project development was the ultimate result of the context learning and the hands-on explorations. It was handled as a professional studio in which the team analyze the site and its culture, create a program, and propose a project and its construction system. Much of the site analysis came from the visit and the tectonic posture from the practical learning, so the development of the project was relatively fast. Even if this was a new method for educators and students to approach a project, learning experience and the results were drastically improved from previous DAU IV workshops.

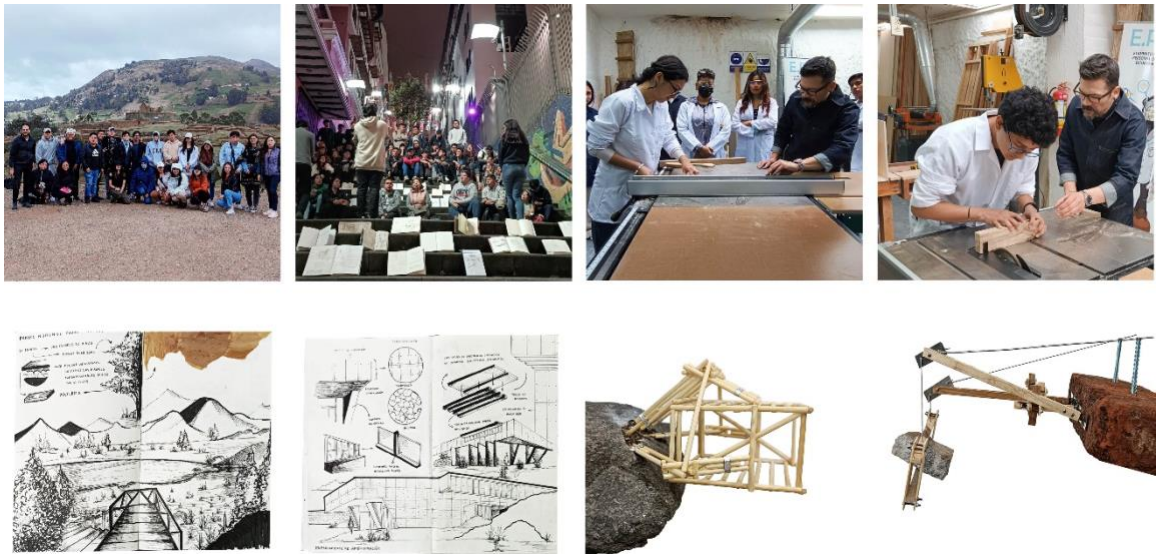

Figure 1. Site visit, technical induction training, tectonic explorations.

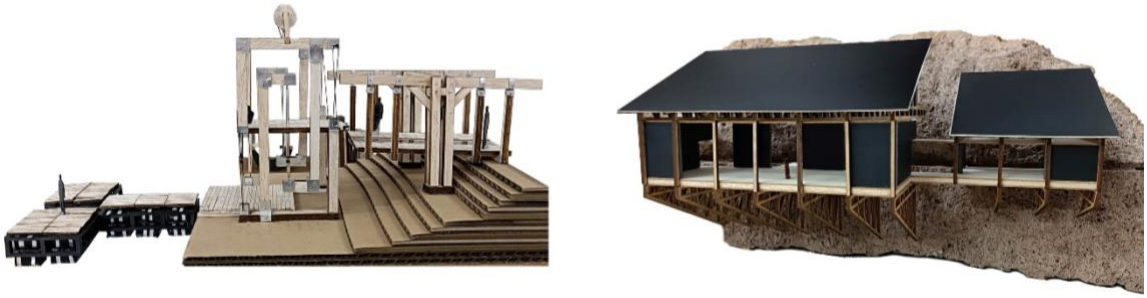

Figure 2. Project´s development.

6 CONCLUSIONS

The DAU IV workshop seeks a real-life approach and hands-on learning to evoke critical thinking and autonomous decision-making by future professionals. As digital media is changing studio culture and students are more exposed to an "ocean of information on the electronic network" (Balfour 2001), we remark the importance of the contact with reality. After analyzing the workshop through neuro-education principles, we confirmed that connecting learning with reality generates positive emotions, thus motivation and meaningful knowledge. Hopefully, this workshop may be a tool for future professionals to make self and coherent decisions before going directly to the internet.

Even though students were motivated during most of the process, especially during the first two stages, timing was frequently a stress factor. Since every stage had a very limited time, students felt pressure and sometimes got tense. Although pressure is undeniable part of real-life, we could review the amount of workload for future editions and make the deliverables more concrete.

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