

GUIDELINES FOR SERVICE-LEARNING ARCHITECTURAL TRAINING USING NEUROSCIENCE AND MOTIVATION TO REDUCE ECONOMIC DISPARITY

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The commercial perception of architecture significantly contributes to global economic disparities. It also prevents sustainable and responsible development in local communities, where future architects will work. This disparity is reflected in the scarcity of formal construction. Over 80% of the buildings worldwide are built without professional planning and with limited resources. Changing how architects are trained is essential to foster a sense of civic commitment and responsibility towards these local realities. Service-learning (SL) architectural training programs that incorporate principles of motivation and neuroscience theories, allow students to holistically perceive their reality. These programs also develop a social consciousness that incentivizes them to improve and voluntarily reach different communities with greater needs. The research follows a conceptual and literature based methodological approach. A structured review of the studies in neuroeducation, SL pedagogy and expectancy value motivation theory was conducted. Key educational principles were identified and synthesized to formulate an assessment guideline for architectural service-learning programs. Three main principles of neuroeducation methodology: emotional stakes and memory consolidation, kinesthetic and multidisciplinary experiences, risk involvement, and four principles of the expectancy-value motivation theory: using the principles of teaching guidance and expectancy-value theory promoting future practices that prioritize sustainable and socially responsible architecture. Through the questions developed the SL program has parameters to guide the focus of the course.

Keywords: Civic engagement, Neuroeducation approaches, Intrinsic and extrinsic motivation, Community-centered design, Social equity.

1 ECONOMIC DISPARITY IN THE CONSTRUCTION INDUSTRY AND SERVICE LEARNING (SL) METHODOLOGY

Great inequalities in accessing education, healthcare, political power and ideal living standards are caused by economic disparity. To further understand the issue, economist Stiglitz (2015) defines this phenomenon as the persistent gap between the rich and the poor, which prevents sustainable and responsible development for all member of society. This disparity is reflected in the scarcity of formal construction, as over 80% of the buildings worldwide are built without professional planning and limited, resources (Vellinga 2018).

This mercantile view of architecture practice, focuses only on serving the luxury interest of a few, overlooking the needs of vulnerable communities (Palero 2021). As a result, construction professionals have not developed a social and civic consciousness towards the impact of their work on their local realities. Hence, architecture practice must change how future architect interact with de local social agents. Such a shift will foster community and citizen commitment (Rubio and Escofet 2017).

Service-learning (SL) is an education method that connects academic learning with community knowledge by bringing academic learning in direct contact with more popular and community-rooted knowledge, creating professionals with a more holistic approach of reality (Rubio and Escofet 2017). This approach allows students to understand their environment by reflecting on a community's real needs and developing the skills for real-life situations, forming conscious professionals that are capable of changing people's lives (Lo *et al.* 2022).

In architecture, SL means apply academic knowledge to solve a specific problem of a community by constructing or modifying spaces. This requires a direct involvement with people that fosters a deep sense of empathy and responsibility towards others. It also equips students with leadership skills, critical thinking and ethical decision-making strategies (Bittencourt *et al.* 2024). Working with marginalized communities helps students acquire essential skills for sustainable development (Bittencourt *et al.* 2024). These skills are helpful for both their professional and personal lives.

However, students do not automatically learn just from engaging in SL activities, they need to clearly understand the value of the service they are performing and acknowledge its benefits to the community (Lo *et al.* 2022). To achieve this, SL training programs can integrate key neuroscience-based teaching methodologies and motivation theories to improve their results and ensure students acquire the proper knowledge to help their local context.

This study seeks to develop a guideline for service-learning architectural training programs by integrating principles from neuroeducation and motivation theory, in order to support socially responsible architectural education and address economic disparity in the built environment.

2 METHODOLOGY

This research adopts a conceptual and qualitative methodology based on a structured literature review and synthesis. The review covers three areas: SL pedagogy, neuroeducation and neuroscience-based teaching and motivation theories in educational psychology expectance –value theory. The first step was a review of academic literature on the three areas. The second step was identifying core principles that improve experiential learning outcomes in community-based programs. Neuroeducation studies were examined to determine cognitive and emotional learning mechanisms, while motivation literature was analyzed to identify factors influencing student engagement. And the alignment of principles with service-Learning architectural practices. And finally identified principles were synthesized into a conceptual framework. These principles were translated into a structured guideline that can assist educators in designing and evaluating service-learning architectural programs.

The synthesis process consisted of identifying recurring educational principles from the literature and grouping them according to their relevance for service-learning architectural training. Neuroeducation concepts were analyzed for cognitive and emotional learning mechanisms associated with experiential design and construction activities. Motivation studies were examined to identify factors influencing student engagement and persistence. These principles were then translated into operational criteria and questions to assess alignment with the parameters.

The guidelines are validated through the theoretical triangulation across neuroscience, motivation theory, and service-learning pedagogy, making them applicable across educational disciplines to produce a structured guideline applicable to architectural training contexts.

3 THEORETICAL FRAMEWORK

3.1 Neuroeducation in Service-Learning Architectural Programs

Neuroeducation, an emerging field within neuroscience, combines psychology and cognitive science to create an effective teaching method that requires hands-on, real-life experiences and a multidisciplinary approach (Villacis and Ayarza 2020). This methodology consists of strengthening theoretical knowledge by applying it to real-world scenarios. This approach dynamically complements SL architectural programs by enabling participants to gain real experiences and acquire the tools to enter their profession and improve their community living standards.

3.1.1 *Key neuroeducation principles to improve SL architectural programs*

Neuroeducation draws on three interconnected principles that strengthen students' internalization of academic knowledge while enhancing their sense of civic responsibility.

- ***Emotional stake and memory consolidation:*** emotions play an important role in the learning processes, directing reasoning into the knowledge sector that allows individuals to face a situation or problem (Immordino-Yang and Damasio 2007) while simultaneously consolidating those experiences. Students' academic formation should be complemented by a range of real-life experiences that motivate curiosity and engagement. This way, meaningful memories are created, helping students decide when and how to apply what they have learned (Immordino-Yang and Damasio 2007).
- ***Kinesthetic and multidisciplinary approach:*** emotions and the body are strongly related (Villacis and Ayarza 2020). Emotions cause mental and physiological effects. If they are directly related to physical experiences, then the more one moves, the more multidisciplinary experiences are created, effectively engaging both mind and body during the learning process.
- ***Risk involvement:*** encouraging students to face real-world settings also implies facing the risks present during building processes. This is essential as it stimulates the creation of memories on how to face challenges in a positive and proactive way, motivating students to handle long-term personal and professional goals (Villacis and Ayarza 2020).

3.2 Motivation in Service-Learning Architectural Programs

Motivation in education is defined as an internal state that arouses, directs, and maintains a behavior (Woolfolk 2021). It is directly related to one's personal goals since it serves as a mental representation that structures the behaviors an individual adopts to achieve a desired objective (Ciesielkiewicz and Nocito 2018). Thus, applying motivational strategies to learning programs maximize the learning outcomes for both students and educators.

The quality of motivation depends on the educational approach, the context and the task's purpose (Ciesielkiewicz and Nocito 2018). Based on the self-determination theory discussed by Ryan and Deci (2020), motivation is categorized by the locus of causality, the reason why (internal or being influenced by something else) a person acts towards a certain goal (Woolfolk 2021), classifying motivation as intrinsic or extrinsic.

3.2.1 Self-determination theory: Intrinsic and extrinsic motivation

According to Woolfolk (2021), **intrinsic motivation** refers to the natural ability to seek and overcome challenges just by pure personal interest. Individuals engage in activities because they find them satisfying and rewarding without any incentive or punishment being required. On the other hand, extrinsic motivation involves behaviors driven by external expectations to engage in an activity (Ryan and Deci 2020), and tends to be associated with negative emotions. However, it can provide the precise incentives for students to willingly participate on activities when those activities serve a greater, personally motivating goal (Woolfolk 2021).

The previous definitions suggest that these two types of motivation can complement each other and the Expectancy-value theory discussed by Eccles (1983) explains this approach.

3.3 Expectancy-Value Theory

This theory helps to conceptualize students' motivation and shows how intrinsic and extrinsic motivation can complement each other to improve the outcome of SL architectural training programs. It considers the integration of two main components:

Expectancy or self-efficacy refers to the students' beliefs about their own capacity to successfully complete a task, and take responsibility for their own performance (Eccles 1983). Meanwhile **value or intrinsic value** refers to the students' interest to accomplish a task they believe is meaningful and helps them reach a desired goal (Ciesielkiewicz and Nocito 2018).

Hence, if students perceive they are capable of performing a task (expectancy) and find the project they are working meaningful (value), they are more likely to persist in the course activities as their motivation levels are higher (Lo *et al.* 2022), improving the overall results for both the community and the students' formation.

3.4 Key Motivation Principles to Improve SL Architectural Programs

Based on the Expectancy-value theory of motivation, Lo *et al.* (2022) developed a model to examine the relationship among students' learning experiences, motivation and cognitive learning outcomes of SL programs from a university in Hong Kong. The following key factors are based on that model and help to improve SL architectural initiatives.

- **Setting learning goals:** setting objectives helps the team define the desired results they want to achieve, aligning with their personal interests to encourage students to deeply commit with the program (Ciesielkiewicz and Nocito 2018). This also serves a criterion to evaluate the performance of the teamwork, essential for students to reflect upon their acquired skills to deal with complex, real scenarios and encourages a sense of civic responsibility.
- **Enhancing learning experiences:** Refers to the creation of challenging, meaningful service programs to maximize the number of experiences students can have. These learning experiences need to be designed alongside the participants and be supervised by educators to allow students a certain level of autonomy to directly interact with the community, understand their needs first-hand and build the best solution for them.
- **Teaching guidance framework:** Educators should enhance their pedagogy to engage students in the program and ensure they meet expectations. Good interactions between educators and students are essential to help the participants work side by side smoothly, allowing teachers to offer the necessary technical and academic support to develop the project. This also provides insightful feedback about the team dynamics, service

- preparations, the impacts on the community and skills students have learnt improving the project's overall results.
- **Motivating students:** Refers to the expectancy-value theory which encourages the creation of highly perceived successful projects with meaningful and interesting activities to effectively motivate students. Projects that allow students to feel appreciated and recognized by communities encourage participants to believe in their ability to successfully complete the project, thereby, improving their performance.

4 RESULTS: GUIDELINE TO AID SL ARCHITECTURAL TRAINING PROGRAMS USING NEUROEDUCATION METHODOLOGY AND MOTIVATION PRINCIPLES

Considering the key principles of neuroeducation and motivation, the guideline was developed, as shown in Table 1, to assist SL architectural training programs through these theories' lens.

For the neuroeducation principle, three parameters were identified, and evaluation questions were developed to assess them. For the motivation principal, four parameters were identified. Each parameter has two or more questions which become the evaluation questions.

Table 1. Guideline to assess SL architectural training programs through the lens of neuroeducation motivation principles. Source: Own elaboration.

Guideline to assess Service-learning architectural training programs		
	Parameters	Evaluative Questions
Neuro-education	Emotions stake & memory consolidation: real-life experiences produce <i>emotions</i> and create <i>memories</i> that provide useful knowledge for <i>professional contexts</i> .	• How does the program effectively integrate real-life experiences to evoke different <i>emotions</i>? • Do these emotions help <i>consolidate memories</i> and <i>meaningful experiences</i> that <i>provide</i> students with <i>useful knowledge and skills</i> for their future?
	Kinesthetic & multidisciplinary approach: the more the <i>body moves</i> while learning the <i>more multidisciplinary experiences</i> are acquired, fully <i>engaging mind and body</i> on the learning process	• How do kinesthetic experiences enhance the learning experiences of students? • Which senses are engaged during research, design and construction process? • How do <i>students responded</i> to the experiences and do these tasks <i>affected their performance</i>?
	Risk involvement: stimulates the creation of <i>memories on how to effectively face real challenges</i> , motivating students to <i>pro-actively face future risks</i> .	• How do students <i>deal with real-world risks</i> present in their profession (diagnosis, design, construction and project follow-up)? • Which <i>problem-solving skills</i> are developed through these experiences?
Motivation	Learning goals: setting clear <i>objectives</i> to encourage desired results, <i>aligning with students' personal goals</i> , and to serve as a <i>criterion</i> to evaluate the <i>team performance</i> .	• How does the program make sure that the <i>objectives</i> set for the project <i>aligned with the students' personal goals and interests</i>? • How are the <i>objectives used to evaluate the project and students' civic and environmental responsibility</i> to face real, complex scenarios?
	Enhancing learning experiences: <i>designing</i> challenging and meaningful <i>learning experiences with students</i> to enhance certain <i>autonomy</i> for students to <i>directly interact</i> with the community.	• Which <i>learning experiences</i> were co-developed by <i>educators and students</i>? • How do educators <i>balance supervision and technical support with the students' autonomy</i> to understand the community and help solve their problems? • How does the program <i>involve students and community in decision-making</i>? • How are students and community involved in decision-making?
	Teaching guidance framework: promoting <i>good interactions</i> between educators and students to offer the necessary <i>technical support</i> and provide <i>insightful feedback</i> about the activities.	• How is the <i>decision-making process within students and educators</i>? How do educators foster a <i>good relationship with students</i>? • How is the <i>team built up</i> to ensure the working dynamics ensure a smooth teamwork? How do educators support students with <i>technical and motivational feedback</i>? • How does the <i>feedback</i> on team dynamics and project preparations helped students improve their knowledge?
	Expectancy-value theory: promoting <i>highly successful projects</i> that allow students to be <i>recognized</i> by the community <i>encourages</i> their <i>ability to complete</i> the project, improving their performance.	• How does the program create an <i>environment</i> that encourages students <i>to believe in the program</i>? • How is <i>reciprocity and mutual responsibility</i> manifested? • Which activities make <i>students feel appreciated</i> by the community and how this affected their <i>performance</i>?

5 CONCLUSIONS

This study developed the guideline to aid SL architectural training programs in applying neuroeducation and motivational theories to foster a deep sense of civic responsibility among future architects as a way to contribute the construction sector to address economic disparity. The guideline showed the following results:

- **Neuroeducation:** neuroscientific principles complement SL architectural training programs since they encourage students to use body, mind and emotions to develop risk-management and problem-solving skills. Allowing students to emotionally engage in collaborative construction processes helps to create core memories that provides practical knowledge on how to deal with the complexity of their local realities while helping to consolidate strong civic values towards their practice.
- **Motivation:** including aspects of the expectancy-value theory helps to humanize SL initiatives while effectively incentivizing students to actively collaborate with a community. By motivating an active and voluntary participation through meaningful experiences, students fully understand the importance of helping people, promoting future practices that prioritize sustainable and socially responsible architecture.

This guideline sets parameters on how service-learning, grounded in neuroeducation and motivation theory, can support the education of architects capable of implementing socially responsible construction practices that address economic disparity in vulnerable communities.

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