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Mock-up / junk lab: hands on practice as an experience in creating a new material

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Abstract

MOCK – UP / JUNK LAB is a semester experiment within the Architectural Workshop course (9th semester), aimed at encouraging research and expanding knowledge about sustainable materials and their potential use in contemporary architectural and artistic practices. The specificity of the task requires a specific method (hands-on practice), where students, by exploring materials, come to new insights and acquire new skills, which significantly differs from traditional educational methods. The new knowledge acquisition experience is based on interdisciplinarity, which integrates both technical and artistic knowledge. By investigating the local context, students map a problem that can become a resource for creating a new material sample. In this sense, reuse gains a new value as a building material, which, in the final stage of research, becomes a usable product. Throughout the research process, the focus is on sustainability methods, ecological principles, participation, social responsibility, as well as the evaluation of the afterlife period.

Keywords: *hands on practice; interdisciplinary practice; mock-up; experiment; circular design.*

1. Introduction

Architectural Workshop is a mandatory course in the fifth year of the Master's Integrated Studies at the Faculty of Architecture, University of Montenegro. The nature of the course requires continuous transformation and adaptation in order to provide students with specific practical knowledge and skills during their final year of study. The workshop format reflects a concept in which students are engaged in creating activities that go beyond conventional and established program frameworks. As a new teaching method, a hands-on practice and experimental approach is introduced, where students work in teams of two, continuously engaging in the execution of tasks. Today, when technological advancements dominate science, it is crucial to maintain the continuity of a practical/craft-based approach in architecture, while

also emphasizing interdisciplinarity in practice. A teaching method grounded in practical activities plays a key role in engaging both cognitive and motor skills, contributing to the development of the psychomotor system. Such activities hold significant pedagogical value, combining artistic, creative, design, and technical abilities of students within each task. Given the multidisciplinary perspective of the educational goals, this learning process aligns with UNESCO's principles of education within a broad and holistic framework (UNESCO's 1996 Delors Commission Report on Education). Traditional educational principles are often detached from real-life problems; in this regard, the hands-on approach can better prepare future architects to think critically about the functional value of materials, connection details, material longevity, and overall sustainability.

This way of thinking may contribute to innovative approaches in architecture—where the local context is seen as an opportunity, and waste as a resource—while acquired knowledge and skills are viewed as applicable and valuable. Moreover, this custom-made approach fosters personalized and authentic design, which is increasingly valued over the uniformity of ready-made system solutions. This form of education can become a driver of positive change, requiring students to be open-minded and flexible in order to meet the demands of a competitive world. By emphasizing a multidisciplinary approach to analysis, problems are considered from multiple perspectives, integrating various types of knowledge and discoveries into a unified outcome. According to Casey Jones (2010), in modern curricula, the interdisciplinary approach is both essential and challenging. Accordingly, students engage in market research, problem mapping, participatory processes, and chemical and physical analysis of material properties. They integrate knowledge of design, usability, and product development, while also becoming familiar with ecological sustainability, social responsibility, and methods for evaluating final outcomes. Working at a 1:1 scale introduces an added layer of responsibility and attention to detail, allowing for a direct understanding of the actual properties and challenges of materials—knowledge that is only acquired through experience.

This method fosters creativity, enabling students to recognize their own abilities and preferences. It also strengthens self-awareness and helps uncover individual potential, which may later translate into business ideas and entrepreneurial ventures. This type of learning process should be grounded in the simultaneous integration of thinking and doing, where new skills are developed and new knowledge is generated.

2. Methodology – from problem to product

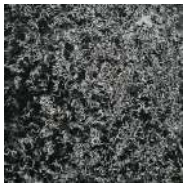
The key method adopted is the experiment, conceived as a continuous semester-long investigation of materials, their properties, transformation, technical characteristics, and aesthetic potential. Within the observational method, one of the key actions is the hands-on practice approach, where students are directed to obtain their material through various processes

such as chemical reactions, melting, mixing, cutting, etc., learning about the materials and their properties through the process, which will later play an important role in their professional practice.

The task is divided into three cycles, starting with mapping the problem (food waste, agricultural waste, plastic, textile waste, production waste, industrial waste, etc.), identifying the causes of the problem, the stakeholders, and understanding the context. This research phase involves collecting statistical data and analyzing the problem, which could turn into a new potential. Students map various materials as potential new resources: construction waste, food waste, plastic, rubber, cigarette butts, glass, sawdust from workshops, fabric waste from local production, cardboard and bags from large corporations and retail chains like Zara, as well as local authentic materials such as wool, olives, pomegranate, etc. Additionally, some students focus on issues such as frequent wildfires in Montenegro, which annually destroy large areas of forests, thus adding a critical perspective to their approach. During the process, stakeholders and potential partners are also mapped, emphasizing the participatory method as an essential social engagement, where every user/citizen can become part of the project. Rebecca Lawthom (2011), in her research, considers the inclusion of the community in the educational process to be crucial, as it both teaches and empowers the community. As part of one team, children from the Pavle Rovinski Primary School contributed their old plastic toys to be transformed into new materials. Local small industries producing juices, cereals, beer (the main state brewery Nikšićka Pivara), costumes, and retail chains like ICOS, Zara, and others also became official participants in the process. After the initial research phase, students draw conclusions that serve as an introduction to the second phase of the investigation.

Table 1. Exapmples of students ideas. Source: Students (2024).

material	**cooperator**	**pattern**	**product**
IQOS cigarette butt	ICOS		ICOS bag
fabric remnants from the production process (offcuts)	Local company for the production of construction suits		A bag for drawings

organic pomegranate bark	Local pomegranate juice factory		Organic label for bottles and jars
Construction waste	Local construction company		Bicycle parking and stand
construction plastic pipes	Local construction company		Substrate for children's playgrounds
sawdust from the production process	local printing house		Eyeglass stands
Cardboard boxes from online sales / ZARA	Boutique ZARA Mne		Shelves for ZARA boutiques
wool	local farm from Pljevlja		wall covering system

children's broken toys	Pavle Rovinski Elementary School, Class III7		Swing for children
corn	local households and flour producers		Children's toys / puzzles
seaweed	Beaches in Ulcinj		beach changing room
Rice that has passed its deadline	local Chinese restaurants		A base for Chinese chopsticks

In the second phase, students focus on analyzing the sample itself and the collected materials by working directly on experiments involving the processing of the material. In home-based, improvised laboratory conditions, students observe material changes (a table set), successively documenting all its transformations. The entire process is monitored and recorded. Students aim to create a new material that could present opportunities for innovative architectural design. In this way, they develop a "biography" of the material, documenting its characteristics (sustainability, fragility, durability, consistency, water resistance, pressure resistance, etc.). For the first time in their studies, students have the opportunity to engage with materials in this manner. This approach can be highly beneficial for their future practice, as the concept of working with materials and analyzing their new applications can significantly change perceptions of materials in architecture and inspire new, personalized approaches and practices. Their initial results are presented publicly in a Pin-up presentation, where all students display their 10x10 cm samples and discuss the process. This form of transparent presentation further enhances the understanding of different processes, facilitating the exchange of ideas and experiences.

Figure 1. Pin up student presentations. Source: Nemanja Milićević (2024).

After presenting the second research cycle and gaining new insights into the material, students move on to the final, third phase of the semester-long research. In this phase, students attempt to produce a final product design derived from the material they have developed. The outcomes depend on the physical and technical characteristics of the material and its properties. Many results are oriented toward creating new, authentic products, such as interior coverings, sound and thermal insulation, children's toys, surfaces for public playgrounds, labels, and interior elements like chairs, tables, and wall curtains. Other products include bags for architectural drawings, laptop bags, boxes for ICOS cigarettes, and similar items. As a measure of the semester's task success, students create a booklet in which they present their product design, technical specifications, assembly instructions, diagrams, and potential applications.

2.1. Evaluation criteria

One of the requirements of the semester assignment is that students must meet four criteria when selecting materials: usability, environmental sustainability, social sustainability, and afterlife, following the methodology employed by the global platform for collecting creative sustainable concepts, Future Materials Bank. Usability pertains to how feasible it is to work with the selected material in various forms and functions, as well as in different contexts. This also includes its potential presence in the market, distribution, and related aspects. Environmental sustainability primarily considers the health and safety of the researchers/students during experimentation, as well as that of the users and the environment where the material is integrated. It raises questions about the extent to which production processes affect or exploit natural resources. To fulfill this criterion, the ingredients should be organically grown or produced without negatively impacting the environment. Additionally, students are encouraged to source materials locally and consider if these resources are renewable in the short term. Special attention is given to ensuring that the process does not directly or indirectly harm animals and that energy savings are prioritized, favoring methods that minimize water and energy consumption. Equally important is addressing waste management: how much waste is

generated and how it is disposed of or mitigated. Social sustainability evaluates the degree to which society, communities, or individuals are involved in the entire process (social activism). It establishes itself as an essential criterion by ensuring that the process respects human rights and is free from child labor. Moreover, ideas based on crafts or techniques with significant cultural or traditional value are highly regarded in this category. Finally, the afterlife of the material considers its behavior and usability over time. Preference is given to materials that can be recycled, are biodegradable, or support multiple or long-term use.

3. Learning outcomes

At the end of the semester, a survey was conducted among students who attended the course to evaluate learning outcomes. The survey consisted of 15 questions covering the methodology, course concept, new experiences, skills, and knowledge acquired. Participation was anonymous, with 78% of attendees completing the survey. The questions allowed for both multiple-choice and open-ended responses. To the first question, "Did the course meet your expectations?" 96% of respondents answered affirmatively. On a quantitative evaluation of course quality, 76% of respondents rated it the highest score (5), 20% rated it 4, and only 4% gave it a medium score (3). All respondents (100%) rated the lecture concept, informativeness, and content with the highest score (5). Regarding whether the semester's research topic aligned with contemporary trends in architecture and design, 88% considered it relevant, while 12% rated it 4 out of 5. On the question about new experiences gained, 92% indicated a positive experience, while 8% stated they partially gained new experiences. Concerning experimental teaching and hands-on practice contributing to new knowledge, 92% responded positively, while 8% indicated partial contribution. Open-ended questions (7 and 8) asked about specific skills and knowledge acquired. The responses often overlapped, highlighting successful mastery of methodological and analytical processes, familiarity with materials and their properties, and the quality of experimental procedures as a new hands-on skill. Question 9 focused on the concept and dynamics of exercises (1+4 structure), noting that in the absence of laboratory facilities, most exercises were conducted in classrooms, in the field, or at home. For this, 68% rated the concept and dynamics with a score of 5, 28% rated it 4, and 4% rated it 3. Methodology evaluation (question 10): 84% rated it 5, 12% rated it 4, and 4% rated it 3. Open-ended responses to question 11 pointed exclusively to infrastructural limitations as the primary shortcoming. Question 12 addressed students' expectations at the semester's end, with all respondents anticipating successful product outcomes. On the topic of result promotion (question 13), most students favored social media and exhibitions as the best channels for showcasing semester research. Questions 14 and 15 inquired about continuing with this method and pursuing it as a potential business idea. A notable 92% expressed interest in continuing this research and exploring its business potential, while 4% were uncertain, and 4% did not wish to continue. Statistical analysis of the questionnaire responses highlights the importance of introducing a

new methodology based on hands-on practice, which results in progress in students' cognitive, communication, and metacognitive skills. Furthermore, taking into account the suggestions from the questionnaire — that the implementation of this method requires adequate spatial and technological conditions — this concept could be established as a leading infrastructural project in the development of the school. Additionally, the results of this experiment indicate that it is of vital importance to integrate the hands-on method and practical learning not only through workshops or laboratories but also to embed this approach more broadly within the curriculum of the School of Architecture.

4. Conclusion

In summary of the conclusions — confirmed by the highly positive results of the survey — if the goal is to achieve contemporary educational methods, architectural education must include practical work within the curriculum, which by nature demands interdisciplinarity. This semester-long experiment demonstrated many positive effects of practical learning through the hands-on method. Most importantly, it enabled a connection between theory and the practical aspects of education, suggesting that this method could contribute to providing a holistic architectural education. Architectural practice in this way enables the development of new knowledge and skills, relying fundamentally on various techniques as well as conceptual notions such as imagination, flexibility, and creativity. Through the hands-on semester exercise Mockup Junk Lab, students start from their own design experience, engaging with abstract concepts which they explore, learn from, and shape into results and new knowledge — in contrast to conventional teaching methods. This experiential method can enhance the application of knowledge and skills in practice and set a new standard in the creation of architectural concepts, while also increasing the number of custom-made, authentic products on the market. Such learning through personal experience gained via experimental hands-on practice ensures a sustainable educational concept and supports lifelong learning as a vision for the future. Considering the growing trend of startup projects and the expansion of EU-funded initiatives that promote innovation, such specific skills could help shape a new model of the creative economy in the market, where students could position themselves successfully in the future.

References

Delors, J. et al. (1996). Learning: The Treasure within. Report to UNESCO of the International Commission on Education for the Twenty-First Century, UNESCO Publishing. https://doi.org/10.7788/ijbe.1996.24.1.253

Emami, N., & von Buelow, P. (2016). Teaching structures to architecture students through hands-on activities. Canadian International Conference on Advances in Education, Teaching, and Technology.

Future Materials Bank. (n.d.). Retrieved from https://www.futurematerialsbank.com

Haury, D. L., & Rillero, P. (1992). Hands-On Approaches to Science Teaching: Questions and Answers from the Field and Research. In ERIC. ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Suite 310, 1200 Chambers Road, Columbus, OH. 43212 ($6. https://eric.ed.gov/?id=ED349185

Jones, C. (2010). Interdisciplinary Approach - Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies. ESSAI, 7(1). https://dc.cod.edu/essai/vol7/iss1/26/

Kolb, D. A. (1984). *Experimental learning: Experience as the source of learning and development*. Prentice-Hall.

Lawthom, R. (2011). Developing learning communities: using communities of practice within community psychology. International Journal of Inclusive Education, 15(1), 153–164. https://doi.org/10.1080/13603116.2010.496212

Nikitina, S. (2006). Three strategies for interdisciplinary teaching: Contextualizing, conceptualizing, and problem-centring. Journal of Curriculum Studies, 38(3), 251–271. https://doi.org/10.1080/00220270500422632