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Enhancing Material Literacy Through Hands-On Workshops in Educational Material Libraries

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ABSTRACT

Materials are foundational to every tangible design project. However, traditional product and industrial design education programs remain largely theory- or software-based, which can limit the development of students' practical, experiential skills in materials. Although hundreds of material libraries worldwide support education, many still function primarily as consultative archives rather than as active learning environments. Since their emergence in the late 1990s, material libraries have provided organised collections of material samples for designers, professionals, and educators, yet their educational potential is often underutilised. This study examines how material libraries can evolve from static repositories into dynamic commons that support hands-on workshops and knowledge exchange. This paper explores how integrating design workshops and material engagement within an educational materials library can enhance material literacy and experiential learning in design education. By activating the materials library as a space where theoretical knowledge intersects with practical experience, this research proposes a replicable model for enriching design pedagogy.

Keywords: Materials library, Design education, Experiential learning, Hands-on workshop, Materials experience

THEORETICAL BACKGROUND

Material Learning in Design Education

The material is being referred to, understood, and in turn defined as the matter or substance used to create objects or products. A material becomes the input in the process of physical construction that influences the properties of what is constructed as a result of the material's embedded materiality (Laughlin & Howes, 2014). Methodologies applied to materials and design teaching have changed over the years, reflecting differences in context, historical period, and the renewal of institutional approaches within design schools (Pedgley et al., 2016).

At the beginning of the design educational path, students usually have limited knowledge of materials, which is based on unstructured personal experiences (Hasling & Lenau, 2014).

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Hands-On and Active Learning Approaches

Materials are abundant in the world around us. From an experiential perspective, material understanding can occur through our senses in every time of interaction (Karana et al., 2015). Traditional ways of teaching materials to designers have proved to suffer from a lack of bodily engagement. The learning process around materials could be enhanced by handling and interacting with them, rather than learn only through theories and tables (Zhou et al., 2018). A practical starting point is to adopt, as much as possible, a teaching approach based on physical materials and product samples. In this way, students can themselves partake in a materials experience first-hand (Pedgley, 2010). By physically interacting with tools and materials, students can develop a concrete understanding of concepts. They can touch, feel, and manipulate materials, thereby enhancing their comprehension and bridging the gap between theory and practice (Kalamkar & Sinhal, 2014). Recent studies have found that students involved in hands-on design and making exhibit increased motivation, self-efficacy, expectations of success, and interdisciplinary awareness (Brubaker et al., 2019). With physical samples, material appraisals inevitably shift from visual to multisensory, which directly mirrors real-life appraisals (Pedgley et al., 2016).

Material Library as an Active Space

The term "material library" is a neologism, coined to refer to physical or virtual locations where technical information is collected and made available for a wide range of materials (Lerma & Dal Palù, 2016). In the late 1990s, material libraries succeeded and provided the first organised collection of material samples to support designers, professionals, and educators. Material libraries for design education were first institutionalised in the UK in the mid-1970s, starting with the Royal College of Art in London. Shortly before, in 1968, the Royal Danish Academy of Fine Arts established its material library (Akin & Pedgley, 2024). Material libraries can be divided into several types, including educational (institutionalised), private (by companies), commercial (suppliers and manufacturers), and digital (software). Compared to traditional material libraries, contemporary material libraries are increasingly designed to foster creative environments. Recently, material libraries such as "Colab", "CSM Material Library", and "MaterFad" have evolved beyond serving as passive archives. They have transformed into multidisciplinary spaces by hosting events, workshops, and collaborative programs, actively promoting creative thinking and innovation in materials. In contrast, material libraries in educational contexts lag behind these innovative models. Most of them continue to function primarily as archive spaces, providing limited opportunities for hands-on engagement or creative exploration.

A WORKSHOP TO TEST NEW DESIGN LEARNING METHODS

To test new ways of teaching and learning about materials, some workshops have been presented to a group of students. The workshops were designed to promote hands-on learning, enhance engagement with materials, and deepen students' understanding of material applications in design. Data were collected

through observational notes, group discussions, and analysis of participants' material artefacts. A thematic analysis was conducted to identify patterns in material engagement, collaborative processes, and the development of design ideas. The workshop included a mood board creation session, during which the materials selected by students and their sensory attributes were analysed. Observational notes were taken during group discussions to document students' interactions, reflections, and collaborative dynamics.

Workshop Execution

The study was conducted at a Material library, located in an Italian design school. The activities had not been performed previously. Two workshops were organised on separate days with Master's and PhD students from the Architecture and Design departments. Each workshop lasted three hours and involved a total of twenty students. The workshops aimed to foster sensory engagement between students and materials within the library's collection. The first workshop, "*Material Stories – Mood Boarding with Meaning,*" tasked students with creating collage-style mood boards using real material samples from the Materioteca collection. The second workshop, "*Sensory Interiors – A Mood Board Workshop on Materials and Emotions,*" asked participants to select themes related to interior styles and develop mood boards using library samples that reflected these themes. During the workshops, company representatives were also showcasing their products and materials.

Both workshops were structured into three sessions: (1) introduction and theme selection, (2) material exploration and selection, and (3) mood board creation. At the beginning of each session, the material librarian provided an introduction to the Materioteca, explaining its resources, organisation, and potential for material exploration. During the workshops, students observed and handled materials, selected samples for their concepts, and collaboratively developed mood boards. Short group discussions encouraged reflection on material properties, design intentions, and creative strategies.

Table 1, presents a detailed overview of the activities and phases for both workshops.

Table 1: Activities of the two workshops.

Workshop	Session	Focus	Activities	Duration
Workshop 1	***Session 1:*** Introduction & theme selection	Orientation and inspiration	Introduction by the material librarian about Materioteca. Informative presentation on workshop structure and requirements; presentation of mood board examples; participants selected themes from printed mood boards; use of pre-prepared A3 collage templates to optimise time	~60 min

(Continued)

Table 1: Continued.

Workshop	Session	Focus	Activities	Duration
	Session 2: Material discovery & selection	Hands-on material exploration	Exploration of material samples in the material library; sensory evaluation and selection of materials aligned with chosen themes	–40 min
	Session 3: Mood board creation & discussion	Concept development and reflection	Creation of material-based mood boards; group discussion and reflection on material choices and design intentions	–80 min
Workshop 2	***Session 1:*** Introduction & industry input	Context setting and material knowledge	Informative presentation on workshop goals; guest company presentation, introducing materials and products	–60 min
	Session 2: Theme definition & material collection	Conceptual framing	Selection of design themes; exploration and collection of relevant material samples from the material library	–40 min
	Session 3: Mood board creation, storytelling & discussion	Collaborative synthesis	Team-based mood board creation; storytelling and presentation of concepts; group discussion and feedback	–80 min
	Total duration: 360 min (6 hours)			

Workshop Process

Workshop 1: *"Material Stories – Mood boarding with Meaning"*

There were 10 master students aged between 21 and 22 from the product design department who took part in the workshop. Students were divided into five groups and in each group, there were two individuals. Each team chose beforehand printed collage papers that illustrated different collage effect themes. Before starting we ask them, if they were in the material library before? Out of ten, we got answer "No". Only 1 student, ones has been in the library. This was surprising as students from design departments rarely have deep interaction with real material samples, although materials are the main concept of their work. Then students start to observe the Materioteca accurately looking for samples in different sections. In the shelfs there are various samples from different manufacturing companies. Each material has detailed descriptions with including sustainability criteria's as well. By scanning the QR, students find additional information about the origin, properties, application area, manufacturing, environmental impact of materials.

Students were divided into five groups and in each group, there were two individuals. Each team choose one printed collage papers that illustrated different topics. The themes that were printed on A3 format representing the Eclectic Movement (eclecttico movimento), Decline Regression (declino regressione), Coexisting and Adapting (coesistere adattarsi), Chaotic Order (Ordine Caotico), Indefinite (Indefinito Inquiltudine) collage's themes. Several materials were selected and applied to printed collage bases, with students combining different material samples to align with their chosen themes. Students curated and assembled multiple material samples into mood boards, exploring the sensorial qualities of materials—including texture, colour, and material relationships—within their design projects. According to Rognoli, the expressive-sensorial dimension of materials is becoming increasingly important in the context of both theoretical and practical design (Rognoli, 2010).

Material Stories Shaped by Emotional Experience

Beyond evoking emotions, the tactile experience of materials can awaken vivid memories, reconnecting individuals with past experiences, including those from childhood. During the discussion, one student reflected that tactile engagement with materials reminded her of childhood moments, when she was instinctively drawn to touching objects in her surroundings but was often discouraged from doing so. Material libraries can serve as spaces where designers develop inspiration and insight through direct engagement with materials and the discovery of new material possibilities. Being allowed to freely touch and explore real material samples was described by the student as both thrilling and liberating, fostering a sense of freedom that encouraged openness to new thoughts and creative exploration. She noted that this tactile freedom supported her creative development and enhanced her ability to generate ideas.

Workshop 2: *"Sensory Interiors: A Mood Board Workshop on Materials and Emotions"*

For this event, we hosted company guests, a well-known Italian brand recognised for its high-quality interior materials and surface solutions. In the starting point the representatives from the company shared detailed information about their company and presented a wide selection of material samples they had brought with them. They introduced various types of woods and wood laminates, including hand-made laminate patterns, as well as different kinds of stones suitable for interior and exterior use. Each material was briefly introduced with explanations about its characteristics, texture, structure, and possible applications. The collaboration with the company supported mutual learning and raised students' awareness of both the characteristics of the materials and their potential applications in design.

The workshop involved ten participants, a mixed group of Master's and PhD students from the Architecture and Design departments. The session began with an informative presentation introducing the context and objectives of the workshop, which was entitled *"Sensory Interiors: A Mood Board Workshop on Materials and Emotions"*. Prior to the workshop, A3 papers with pre-printed themes related to interior styles, such as Classical, Modern, and Neoclassical theme styles were prepared. Each student selected a theme and was tasked with creating a mood board based on it. Following the introduction, participants explored and selected material samples from the Materioteca, as well as a few additional samples provided by the guest company. Over the workshop, students transferred their selected materials and ideas onto their mood boards, integrating textures and colors, to develop a coherent design concept. Participants were highly engaged, demonstrating curiosity and excitement when encountering unfamiliar materials. This highlights the unique value of the material library, where students can discover innovative and previously unseen materials that inspire new design ideas. During the material exploration phase, each group engaged in brainstorming sessions to develop concepts for their mood boards. The resulting concepts varied between groups, reflecting different design intentions and thematic approaches, such as sustainable materials, sensory experiences, cultural identity, and interior design applications.

DISCUSSION

At the end of the workshop, each group presented mood boards developed around distinct concepts. Throughout the workshop, students explored a wide range of materials and reflected on how tactile interaction influenced emotional perception. The findings from the two workshops highlight the central role of direct, tactile engagement with materials in shaping students' understanding, emotional perception, and design thinking. Hands-on engagement in material design education enables students a deeper and more nuanced form of understanding material literacy. The workshops indicate that involving experiential learning activities in material libraries, can support students in connecting material properties with sensory, emotional, and conceptual dimensions. The observed interactions demonstrate how multisensory exploration allows students to articulate design intentions through material-based storytelling. In this context, the material library functions not merely as an archive of samples, but as a pedagogical infrastructure that supports experiential learning, collaboration, and knowledge exchange. Activating material libraries through hands-on workshops represents a scalable and transferable approach to embedding experiential learning within design curricula, particularly in educational contexts where direct interaction with materials is often limited.

CONCLUSION

The findings from both workshops demonstrate that hands-on learning plays a crucial role in materials design education by strengthening students' engagement with materials. Direct interaction through tactile exploration and experimentation enables students to develop a deeper understanding of material properties, behaviours, and potential applications. Embedding practical, experience-based learning within educational material libraries enhances material literacy and supports the development of creative and meaningful design outcomes. Developing the materials library as an active learning environment through workshops and events can encourage student participation while fostering curiosity in engagement with the library's resources. In this way students can explore materials that are continually evolving and allowing them to stay informed about current trends and innovations in material design. Although based on a limited number of workshops within a specific context, this research offers a replicable model for activating educational material libraries through hands-on activities. Future research could investigate the long-term impact of such interventions on students' design practices and material decision-making, as well as explore comparative studies across institutions. Overall, the study contributes to ongoing discussions on material literacy and experiential learning by demonstrating how material libraries can be transformed into dynamic spaces for learning, experimentation, and knowledge exchange in design education.

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