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EXPLORING THE GAP BETWEEN STUDENT-CENTRED LEARNING AND STUDENT'S LEARNING OUTCOMES: A CASE-STUDY OF A MATERIALS FOR INTERIOR DESIGN CLASS

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ABSTRACT
The paper describes the challenges encountered in teaching a class in materials for interior design. Usually, materials science is studied as a separate discipline in which the characteristics of the most popular materials, their processing and application are explained. To encourage student-centred learning, a variety of strategies were proposed to attack the problematic of the discipline in a holistic way and to provide a more meaningful learning for the students. Among these were flipping the classroom, project-based learning, gamification.
However, a major shortcoming was outlined – students did not find the direct relevance of the gained knowledge to other disciplines where specific products are designed. This observation was further proven by students' performance in the subsequent design studios where their understanding of materials was quite superficial. This paper is an attempt to unravel the reasons for this discrepancy. It is a critical analysis of the applied student-centred learning approach questioning the priority of creating a positive learning experience over the importance of authentic knowledge acquisition.
The drawn-on conclusions aim towards achieving greater efficiency of the student-centred learning and, how it can support the construction of durable knowledge and the development of 21st Century skills fully relevant to the design profession.

Keywords: Student-centred learning, learning outcomes, student engagement, materials knowledge

1 INTRODUCTION

Nowadays materials science is one of the fastest developing industries recognized as a key factor for the prosperity of developed nations and a driving force for global economic growth [1]. Technological advances have led to an exponential growth of the variety of materials that contemporary designers have at their disposal. On the one hand new synthetic and composite materials are constantly being developed, and on the other – the technical characteristics of well-known materials are being transformed, leading to a great expansion of their potential applications in design. In the past, designers had adhered to the conventional properties of the material while product's shape was dictated by materials' innate form-formation qualities. The trend today is towards intelligent use and interpretation of materials' properties that is both technically and aesthetically innovative.
All these prerequisites create new challenges for design education. Usually, in design school's materials science is studied as a separate discipline in which the characteristics of the most popular materials are explained via lectures and lab work. Such is the case with the subject 'Materials for interior design' in the Department of Architecture and Habitat Sciences at the University of Monterrey in Mexico. The class is considered as one of the highly theoretical classes in the curriculum as students need to be acquainted with the composition, technical properties, manufacturing processes, environmental impact, intangible characteristics, etc. of the most popular materials of each materials group. Obviously, presenting the excessive information in a traditional lecture-based class does not respond to the needs and expectations of the millennial students. The shift from teacher-driven, instruction-based, passive-learning model to a student-driven, learning-based, active-learning model has been long recognized as more effective and hence widely implemented as a teaching paradigm in higher education [2]. Also, to make education relevant, the impact of technology on the learning process must be acknowledged and used as a medium to engage our students in their ideal way of learning [3]. Furthermore, in addition to

the understanding of the constructivist theory that students should become active constructors of their knowledge, the network learning theory is gaining popularity [4]. Based on chaos, network and complexity theories it argues that meaning exists and it is a challenge for the learner to recognize the pattern and to acquire the knowledge. Accordingly, learning which is a self-organizing process at a personal or community level takes place when students begin to make connections.
To encourage active learning and collaboration, various strategies were introduced in the course to attack the problem of the discipline in a holistic way and to provide a more meaningful learning for the students. Among these were flipping the classroom, implementation of project-based learning, introduction of gamification. The main objective of the course was to create a learning environment addressing the strengths of the students and positioning them in the role of independent learners. The proposed assignments included various activities aiming to construct appropriate knowledge of materials in relation to both their structural and visual characteristics.

2 STUDENT-CENTERED LEARNING PRACTICES

To design appropriate student-centred class activities which respond to the needs of contemporary students and focus on their learning a good understanding of the specifics of the teaching strategy and how it can be implemented in higher education is required. Despite its widespread use, the definition of student-centred teaching is quite loose and to a great extent instruction continues to be teacher-centred as faculty is still making most of the decisions for the students [5]. In search of an appropriate description of the theory and practice of student-centred strategies researchers are often based on its comparison with traditional teaching. Weimer [5] identifies five areas where the traditional teacher-centred instructional practice needs to be changed to sustain student-centred learning:

- The *role of the teacher* to promote learning by facilitating the acquisition of knowledge and supporting the learning efforts of the students. The principles guiding the effective execution of this role are to engage students more in the learning tasks, to let them discover the information by themselves, to create significant learning experiences, to demonstrate more explicitly how professionals approach learning, to encourage students to learn from and with each other, to create a climate which stimulates learning, to provide constructive feedback.
- To share the *balance of power* with students by giving them the opportunity to control the learning process thus helping them to develop as autonomous, self-directed and self-regulating learners.
- The *function of content* should be considered as a means of knowledge and not as an end so that students are equipped with the learning skills, they need to learn the content by themselves.
- Students should assume the *responsibility for learning* and experience the consequences of the decisions they take in the learning process. The teacher's responsibility is to create conditions which motivate students to learn by showing them the value and necessity of learning.
- The *purposes and process of evaluation* – focus on the development of self- and peer-assessment skills so students get more involved into the evaluation activities without compromising the integrity of the grading process.

The effectiveness of removing the teacher from the centre of the classroom derives from the fact that students' needs, opinions and goals are acknowledged, teaching is guided by what is best for them, they are more engaged in the learning tasks and learn by doing. When successfully implemented in the educational practice it grants the opportunity to students to acquire knowledge in an optimal way.

3 MATERIALS FOR INTERIOR DESIGN – COURSE OBJECTIVES AND SPECIFICS

The general aim of the course is to introduce students to the most used material types in interior environments and to acquaint them with the fundamental aspects of materials selection. The expected learning outcomes that students should acknowledge and be able to demonstrate because of the learning process were formulated as follows:

- To describe the specific characteristics of the most typical materials used in interior design.
- To distinguish the functional properties, limitations, environmental impact and formal design possibilities of commonly used materials.
- To understand the basics of materials extraction and processing.
- To understand the criteria affecting materials selection in interior design.
- To compare alternative materials for a specific use, to compare their advantages and disadvantages

and to select the more appropriate one.

- To identify the possible use of materials in a variety of interior contexts both as a surface finishing and as structural entities.
- To make a design statement using materials.
- To "think" through the material when developing interior design projects.

In section 2.1 are outlined the activities and assignments implemented to achieve these outcomes, the shortcomings observed and the discrepancies with the objectives. Table 1 illustrates how each activity is goal-oriented and planned to develop specific skills.

Table 1. Planning of learning activities and assignments according to the learning outcomes

Learning objectives	Learning activities and assignments							
	Material's story	Material of the day	Workshop visits	Field trips	Materials library	Celosia design	Sustaina-bility profile	Materials catalogue
To describe the specific characteristics	●	●	◑	●	●	◑	○	●
To distinguish the functional properties	●	●	◑	●	●	◑	○	●
To distinguish the limitations	◑	◑	●	◑	○	●	○	●
To understand the environmental impact	◑	◑	○	◑	○	○	●	●
To comprehend the formal design possibilities	◑	◑	●	●	◑	●	○	●
To understand extraction and processing	◑	○	●	●	○	●	●	●
To understand the criteria in materials selection	○	○	◑	◑	●	●	○	●
To compare alternative materials	○	◑	○	◑	●	●	●	◑
To identify possible applications in interior design	◑	●	◑	●	●	●	○	●
To make a design statement through the material	○	○	◑	○	◑	●	○	◑
To "think" through the material in the design process	○	○	◑	○	◑	●	○	○

● Fully meets the learning objective
◑ Partially meets the learning objective
○ Does not meet the listed learning objective

3.1 Assignments' objectives and outcomes – a comparison

3.1.1 Material's story

Because knowledge in materials science is growing exponentially the "know-where" understanding of where to find the necessary information is an extremely important ability [4]. To stimulate students to construct their own learning using a variety of sources of information and to challenge them to distinguish important from irrelevant data the first activity aiming towards acquisition of general materials knowledge was to write the 'story' of a material. Students were required to represent material's role in design approaching it from a variety of perspectives, including its history, applications, fabrication processes, environmental aspects, etc. The class was divided in teams and each was given the opportunity to choose a different materials group to research and present its story in class instead of a teacher-based traditional lecture. To support students in their preparation the teacher presented a concept map to visualize the main aspects that needed to be covered in-depth. A complementary presentation was prepared to compensate for any major omissions in the students' stories which could be used as a reference source as well.

Contrary to the expectation that the students would be more creative in approaching the assignment both in terms of its content and presentation the results were rather mediocre. All deliverables used the format of a conventional PowerPoint presentation and none experimented with more attractive representational means (e.g. infographics, visual maps, videocasts, etc.) to convey the information in a more effective way. This was a surprising finding as millennial students are accustomed to using visual stimulations and in general are quite demanding towards their teachers to be more interactive and to apply a variety of visual means in their explanations. The contents of the presentations themselves were neither profound enough nor represented any curious facts about the material. Sometimes the presented information was too rudimentary or totally irrelevant to the subject. The reason for this being that the references used for the preparation of the presentations were solely online sources. None of the teams used books, even electronic ones, though the university library has an abundant database of books about materials. Also, the information regarding the extraction and manufacturing processing of materials was entirely missing because according to the students' opinion it was not connected to the design profession. As a result, instead of arousing the curiosity of students and stimulating them to unravel the 'story' of the material and introduce the most intriguing information in a compelling way the presentation turned out to become a pale copy of a traditional lecture delivered by the teacher accompanied by poor interest from the other students in the class.

To compensate the observed lack of motivation and to bolster students' intrinsic interest "material of the day" assignment was introduced. Students were encouraged to explore materials databases and design blogs to search for innovative materials or interesting applications of well-known materials and to bring back the information in the class environment by sharing it with other students in the blog on

the institutional platform Blackboard. They were asked to review and discuss the input by their peers thus broadening their knowledge through co-learning. To stimulate participation, additional points were earned. The assignment proved to be a successful attempt as students were self-motivated to contribute to the creation of this materials database. They were satisfied when they submitted a blog entry which aroused interest and a competition was naturally established between them to find more exciting examples.

3.1.2 Materials beyond the classroom

To develop a more integral understanding of materials, substantive activities extending the boundaries of the classroom were planned. The aim was to provide a hands-on experience of materials and acquaint students more closely with the manufacturing processes. After the class discussions about the extraction and processing of the relevant materials group supported by short video demonstrations, laboratory exercises were organized in the metal, woodworking, ceramics and polymer workshops at the university where students had the opportunity to experiment with the technological capabilities and limitations for form-giving of the different materials. Though some of the students were afraid to work with the machines and preferred to observe only the demonstrations delivered by the laboratory assistants the experience was useful as they were able to interact with the materials.

Another aspect of the course was the introduction to local suppliers and manufacturers so that the students get acquainted with their manufacturing capabilities and the products they offer. Among the visited companies were a stone supplier, a factory producing ceramics, a textile import company. These field trips were very helpful as students could initiate building their own network of professional contacts. Also, during the semester students worked very extensively with the materials library provided by Material ConneXion.[1] Besides exploring the digital database they were encouraged to use the physical library at the university to learn about the sensorial-expressive language of materials, to compare them and discover possible uses.

All these out-of-classroom activities aimed to prepare students for their future career by showing them that learning has variety of dimensions and to focus on the importance of self-directing their own needs to locate the sources of information that can be used to gain knowledge in regard to materials.

3.1.3 Learning about materials by doing

Another teaching strategy supporting student-centred learning is experiential and authentic learning [6]. A common practice of implementing this strategy in the classroom is project-based learning which positions students in a real-life situation and helps them understand the direct relevance of the knowledge gained in class with the design practice. Students were challenged to design a *'celosia'* – a typical architectural lattice used in Mexico, traditionally made of concrete, brick or wood. To encourage out of the box thinking the assignment required to interpret a design found in the local context in a modern material by their choice. As authentic learning builds bridges across disciplines, in this assignment students had to research the vernacular methods and materials used for building celosias, to explore the construction techniques and manufacturing processes of the newly proposed material and to compare them. Unlike theoretical classes when students discuss materials without a specific context when facing the task to design a product a more in-depth research on the detailing, manufacturing, methods of joining and assembly of the selected material was expected. Unfortunately, students concentrated more on the aspects of the design where they felt more confident – the form itself and its presentation. As they did not reach the required level of detailing the form did not originate from the inherent propertied of the material and the presented projects did not meet the assignment objective to "think" through the material in the design process. Despite the unsatisfactory results, with the provided feedback the likelihood that students learned from this experience increased.

3.1.4 Materials' environmental aspect

The impact of materials on the environment is considered as one of the aspects that is mandatory to be considered in the materials selection process. Therefore, the 'Sustainability profile of wood and wood-based materials' assignment was introduced. The objective was to direct students' attention to this important issue and to make them more apprehensive towards considering it in their future practice. The requirements were to create an environmental profile of a solid wood and a wood-based material as one

[1] Leading materials consultancy maintaining an extensive online materials database and a physical materials library.

of the most commonly used materials in interior design, to define the negative environmental impact of each and to compare their life-cycle in order to determine which is less harmful and hence advisable to use. The assignment was given at the end of the semester and supposed more profound research on the extraction, manufacturing, construction, use and potential for recycling and reuse. However, what students presented was mainly a comparison of materials properties and application in design and the respective conclusions regarding materials sustainability were made on that basis. Again, the source of information used was internet and hence the impression that they were not able to differentiate the important from the irrelevant information was reinforced.

3.1.5 A project instead of an exam

It has been long observed that when preparing for exams students rely mainly on their short-term memory. They memorize the facts and soon after the exam they are not capable of retrieving this information when they need it. In line with the strategy of student-centred learning the final grade of the course was determined by a project which focused on the development of abilities to analyse, synthesize and judge. Students had to build up a catalogue of materials where they needed to identify, classify and describe materials used in interior design. The catalogue consisted of a physical part with samples of the materials and a digital part where materials properties, manufacturing and processing, availability, typical application, maintenance, etc. were described and visualized. To promote students' independence self-assessment and peer-review of the catalogues was assigned. To aid students in the process, evaluation rubrics were provided to which they were expected to adhere. Though initially perceived as additional work, which is superfluous, involving students in this evaluation activity helped them judge the quality of their own work by comparing it to the work of others. The intention was to gain confidence in their own opinion and to learn to appreciate the value of outside perspectives.

How did students perform in this last project which compiled the knowledge acquired during the semester? Regarding the coherence of the catalogues most of the students provided well-structured contents with attention to its visual representation. However, regarding the depth of the research, the accuracy and relevance of the data included there were severe omissions or inconsistencies. Students continued to use internet as the only reference without using critical thinking in the selection of appropriate data. The lack of abilities to discern the sources with greater authority which they can rely on is evident. They showed incapacity to evaluate the information and to properly interpret and synthesize it. Another observation was the unawareness of the ethical use of information as they did not give credit through appropriate citation.

4 DISCUSSION

It has been recognized that student-centred approaches are less efficient than didactic instruction because they need more time and respectively the course content cannot be fully covered [5]. Conversely, a greater depth is produced as the fewer topics are researched more extensively and systematically. This is considered to be more valuable in terms of learning outcomes as students master strategies which can be applied later and acquire skills in critical thinking, problem solving and decision making that are looked-for in the knowledge economy of the 21st Century. The main goal to introduce student-centred learning in the course "Materials for interior design' was to motivate students to become active participants in the educational process and to increase their potential to cope with the increased demands towards designers in the context of today's rapid changes. Despite the lofty goals set in the programme several difficulties aroused from its implementation. Most of the activities were designed to encourage more autonomous learning through performing self-directed research and sharing its outcomes in a collaborative environment. The main observation is that students were not yet prepared to take the responsibility to control their own learning which is a major prerequisite for the successful implementation of the student-centred strategies. Four of the five actions suggested by Weimer [5] to orient teaching towards the needs of the students are based on changes that the teacher need to undergo but the responsibility for learning requires actions from the students themselves. And this can take place only when students are sufficiently mature and intrinsically committed to learning. In general, students are still quite passive, they are accustomed to receiving instructions how to approach the assignment, what references to use, how to present it and practically do not take any initiative. In a survey at the end of the semester 80% of the students responded that they prefer to receive precise instructions how to develop the assignments and only 30% were willing to search additional references and readings not assigned by the teacher. This was additionally confirmed by answers to the question "What encourages you to explore a topic beyond what was discussed in class?" such as "When the teacher suggest web-

pages to find more information." Furthermore, only 20% defined themselves as self-directed learners. Another disturbing finding was that when asked what stimulates their learning, half of the students ranked on first place the grade and 30% put the knowledge gained on the bottom of the list. "My grade" was also one of the top answers to the question "What stimulates me most to participate in the educational process?"

The proposed activities tried to create a learning environment which provides choice and presents opportunities to gain knowledge about materials from various perspectives. The direct observations of the educational process showed that students perceived the class as a disconnected subject without comprehending the larger context in which materials fall and hence were not effectively engaged with the content. The first alarming signal that the student-centred approach was not working well in terms of knowledge acquisition was noticed during the Q&A sessions which followed each section of the class when a certain materials group was covered. It was found that students were able to answer questions only partially regarding the material group that they researched and were unable to define even basic concepts for the other material groups. Obviously, the first learning outcome to describe the specific characteristics of the most typical materials used in interior design was reduced just to a single group. The other activities also did not contribute to the creation of deep understanding of the importance of materials for product innovation. Furthermore, this perturbing observation was confirmed not in the formal evaluation at the end of the course but in the subsequent design studios where students still showed a superficial knowledge of materials. This leads to the perturbing conclusion that the initially planned learning outcomes of the class were not achieved. Among them – comparing alternative materials for a specific use and selecting the more appropriate one, making a statement using materials and "thinking" through the material during the design process.

5 CONCLUSIONS

In conclusion, the benefits of implementing student-centred teaching are extensively researched and proved but the approach should not be implemented without critique and by compromising students' knowledge. We need to rethink the methods we use in teaching so that we not only address how to deal with students' passivity and lack of motivation but how to get better learning outcomes. A possible approach is to interrelate materials course and the design studios so that students make a more meaningful connection of the theoretical knowledge with design practice. By "bridging the divide between 'knowledge about' and 'experience in' materials" [7], students can appreciate in a better way the value of the theory and perhaps absorb it more successfully.

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