PEER LEARNING FOR DESIGN

Creating a New Learning Experience for Design Education

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INTRODUCTION

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When thinking about the challenges of our time, it becomes clear that education is our best chance to create a sustainable future. We face problems that have not been solved before, requiring us to empathize and collaborate with others, finding ways to share knowledge and resources that will allow us to think in new ways and find better solutions. An education in design has the potential to provide a space where learners develop these skills.

The mindset of designers allows them to develop creative solutions to complex problems by observing and analyzing the world that surrounds them. However, to acquire these tools and skills, teachers and institutions need to create opportunities for learners to explore their abilities, exercise their skills, and shape their understanding. Here is where this thesis begins; by researching and analyzing traditional and innovative teaching methodologies and their current application in Politecnico di Torino's education to identify opportunities that frame and conceptualize a new learning experience for design education, which, in line with the university's Strategic Plan for 2024, develops transversal skills that prepare students to face the challenges of the future.

Methodology

Given the open-ended nature and complexity of this thesis, it is not certain that ideas or concepts of the past will solve the challenges of the future. Therefore, an approach for design and innovation centered on the relationships between users and their context becomes fundamental to guide the project. Thus, the methodology used is based on the project path outlined by the Innovation Design Lab of the Politecnico di Torino, created to promote innovative and sustainable projects. (Tamborrini & Stabellini, 2018)

“Through a process divided into three main phases, it is possible to translate the collection, analysis, and visualization of users and territorial data into an innovative concept and drive its development into a realization of a sustainable innovation.” (Innovation Design Lab, 2018)

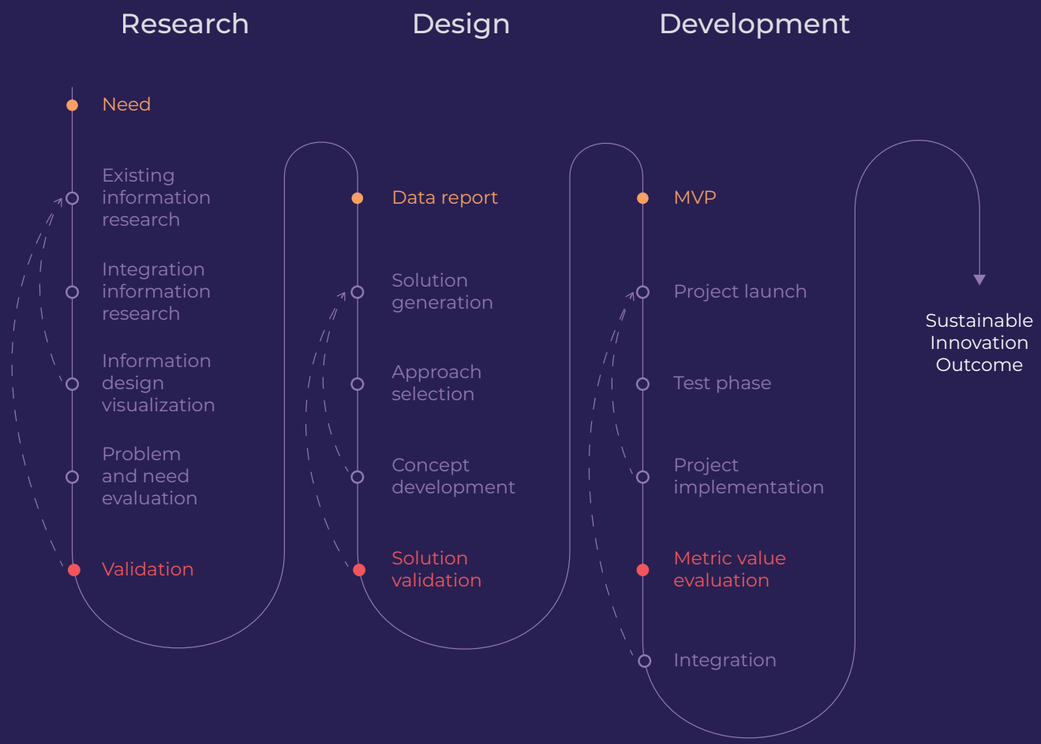

Figure 1: The Project Path by Innovation Design Lab of Politecnico di Torino

The research phase starts by identifying a need, problem, or opportunity. This initial stage “has the purpose of mapping the domain of action, the territory of interest, through an analysis of natural, social, economic, cultural, or historical resources, identifying their strengths and weaknesses, criticalities, and opportunities” (Tamborrini & Stabellini, 2018). The first research approaches are of existing information sources and documents written about the problem and its context. It refers to desk research that gives the researchers a general comprehension of the topic and the as-

to the field, gathering more information through interviews and user experience maps. All this data and information is collected, mapped, and analyzed to visualize and understand the most critical problems and needs. The output of this first phase is a data report, a document that summarizes the investigation done and the results encountered that define the direction that the project will take.

The second stage of the process —the design— takes the information on the data report and uses it to generate ideas and solutions to the problems discovered. Afterward, these solutions are validated with user and context data to assess their effectiveness and accuracy. This process leads to developing a design concept that presents the characteristics and components of the projected solutions. However, these solutions cannot be approved and implemented without analyzing their impact and influence on the users and context. Therefore, a constant process of analysis and ideation has to occur to reach the best solution and ensure that any effects may be identified and prevented.

Due to the amount of time and resources available, the development of this thesis will reach as far as the solution validation. The project's goal is to present a final product that can be implemented in a design course. The development phase remains a future scope to be carried out and tested in a course with students who can give feedback about the experience.

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EDUCATION

According to Cambridge (2013), education is “the process of teaching or learning, especially in a school or college, or the knowledge that you get from this.” This definition describes education as an activity involving teaching and learning, usually represented by two subjects: a teacher and a learner, which interact to transmit and create knowledge through different experiences.

Education originates in most societies to culturize children in the ways of living and social agreements that help society function. In more primitive societies, the role of educating children falls on their parents and their close community, who have learned from their ancestors how things work and pass millenary knowledge through oral tradition and teach by example. When children grow and get past puberty, most societies start considering them adults and start passing on more specialized knowledge about their role in society and the work they will come to do in the future. In these contexts, teaching is done by figures influential in the field, and learners come to interact with a broader range of people of the community.

Education development shows us that “education has no specifications or boundaries assigned to it” (Ecole Globale, 2020). However, there are different contexts and forms in which people learn that are categorized by the degree of formality. For example, informal education is knowledge acquired through life experiences, copying from parents and elders, and exploring possibilities within the environment. It does not require a particular method or curriculum and is usually related to skills necessary for survival and sustenance. This form of learning is usually guided by the resources and experiences of the individual in their context, so it is very spontaneous and particular to each learner.

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On the other hand, formal education occurs in a structured context such as a school, guided by a curriculum or program that explicitly presents learning objectives, time-frames, and certifications. Graham (2021) argues that formal education and teachers as we know them are created when societies grow in complexity and the amount of knowledge amassed is greater than what one person usually knows. Thus, formal education is regulated by norms and standards that span schools, universities, and even national education programs.

Institutions create education systems to coordinate and regulate formal learning activities and ensure that learning is intentional and guided by teachers. These include education institutions, trained teachers, curriculums, and certifications that interact to create learning conditions within the desired guidelines.

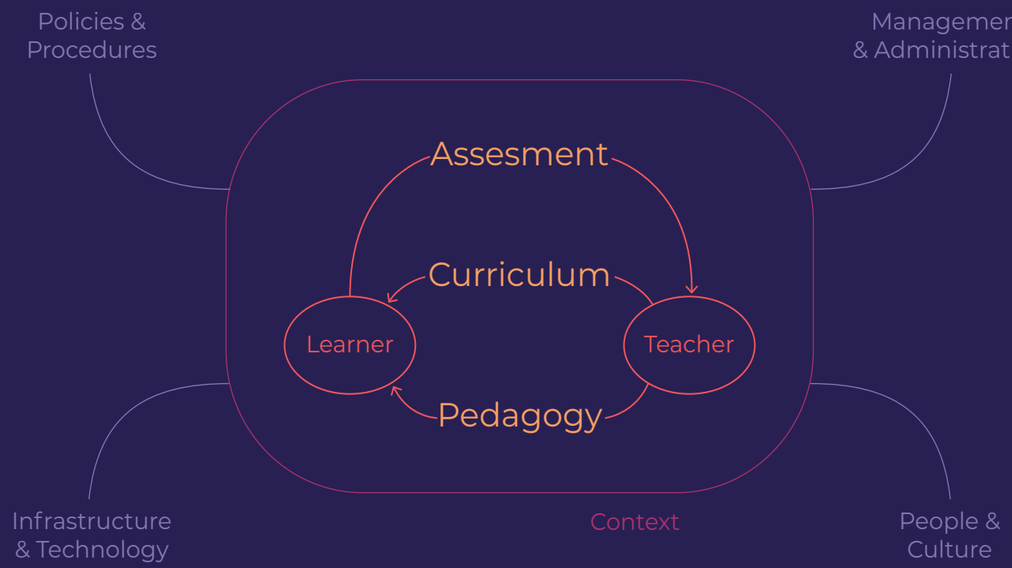

Figure 2: The education system

Education is a complex system because its actors have experiences and backgrounds that directly affect how they teach or learn. Additionally, the system considers not only teacher-learner interactions but also the coordination of individuals (among teachers, administrators, and students), infrastructure, functioning institutions, and processes to provide educational services. (Top Hat, n.d.) Due to this complexity and the different laws and

cultural practices surrounding learning processes, education systems vary across countries and institutions.

To make education systems easier to confront and evaluate, UNESCO (2011) proposes an International Standards Classification of Education (ISCED) that classifies education programs into nine levels. Starting from early childhood education up to doctoral university degrees, in the following way: level 0 - Early childhood education, level 1 - Primary education, level 2 - Lower secondary education, level 3 - Upper secondary education, level 4 - Post-secondary non-tertiary education, level 5 - Short-cycle tertiary education, level 6 - Bachelor or equivalent, level 7 - Master or equivalent, level 8 - Doctoral or equivalent, and level 9 - Not elsewhere classified.

Learning

Learning —the first half of the education process— is defined as “gaining knowledge or understanding of or skill in by study, instruction, or experience. A consequence of ongoing interactions between people and their environment” (Merriam-Webster, 2021). As societies evolve and become more complex, so does education and the topics it addresses; it becomes less about surviving and daily life and more about abstract and specialized concepts (Graham, 2021). At this point, learning and pedagogical theories start developing to explain and improve the way education is structured and imparted.

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Learning theories focus on how individuals acquire new understanding, knowledge, behaviors, skills, values, attitudes, and preferences. Although learning occurs naturally, as an evolutive response of organisms to stimuli from the environment that makes them modify their behavior in a lasting way to help them operate through experience (Gambini, 2016), the different theories explain how this happens inside humans’ brains. Here is where the four main educational theories come to play:

Behaviorism:

Originated from Pavlov’s experiments on classical conditioning with dogs. It suggests that positive and negative reinforcement shape behavior and focuses on changes in individuals’ observable behaviors. This theory is teacher-centered, assuming that the learner is passive, responding to external stimuli without elaborating on this information. It also considers learners as blank slates that need to be provided with stimuli and information to learn; it does not consider previous experiences or backgrounds that might affect the learning process.

Cognitivism:

As suggested by Piaget, learning occurs through the mental processing of knowledge that changes behavior. Cognitivism considers mental processes such as thinking, memory, knowing, and problem-solving. Here learners receive inputs that they process in their short-term memory to then store in the long-term memory for later use. It views changes in behavior as a consequence of thinking and processing information; they reflect what goes on in an individual’s brain.

Constructivism:

Learning is considered an active process where individuals not only acquire knowledge; they construct it. The construction of this knowledge is different for every learner due to their past experiences and constructed mental models; each one interprets, organizes, and connects information differently. Additionally, social constructivism suggests that learning is accelerated when participating in group activities and discussions. Finally, because learners construct knowledge, the people around them influence their experience, especially experts or more knowledgeable people.

Connectivism:

Developed by Siemens (2005), it is one of the newer theories of learning brought by the digital era. It is based on the principles of chaos, networks, and complexity, and self-organization theories.

Considering that humans acquire knowledge by experience, but it is impossible to experience everything, other people's experiences become our source for knowledge. In a time when technology has made it possible for people to connect and share information efficiently, learning shifts from the individual to the collective —to the network.

Connectivism recognizes that learning is different when information is readily available. The focus of what a person needs to learn shifts from acquiring and memorizing a large amount of information to identifying what information is needed and where it can be found. The focus of learners, according to connectivism, should be creating connections with others through technology that will allow them to access knowledge.

Learning networks are the base of connectivism theory; they allow students to partially rely on technology to support their learning process, storing information outside of themselves and creating meaning with others.

Teaching

On the other side of the education equation, teaching involves sharing knowledge and experience, providing stimulus to another person's psychological and intellectual growth, and it is usually organized within a discipline. (Impedovo & Iaquinta, 2013)

In each of the learning theories, the teacher plays a different role in the learning process. In behaviorism, teachers are the primary source of stimuli and information, while in cognitivism, they provide students with guidance and resources to keep them engaged. In constructivism, their role is to assist learners in their process, adapting the contents to each learner's experiences and previous knowledge, checking for misconceptions that may arise while learning. Finally, in connectivism, the teacher creates the conditions and opportunities for learners to create connections and acquire the skills needed to keep learning in the future.

These, combined with the social, cultural, and political context, the teacher's experiences and knowledge and their beliefs and attitude towards learners result in infinite ways to approach teaching. The study of these methods, in theory, and practice, are known as pedagogical theories. Given the vast amount of pedagogical approaches, a classification that ranges from teacher-centered to learner-centered is used to organize them. Teacher-centered methods focus on direct instruction where the teacher delivers content in a unidirectional way, while in learner-centered approaches, students are active participants in their learning, and the teacher serves as a mentor or supportive figure. (2U, 2020)

Photo by Yan Krukov for Pexels

Given the vast number of teaching approaches, it would take too long to analyze each of them. For this exercise, we will review those most relevant to our work.

Based on the constructivist learning theory, the constructivist teaching approach claims that learning is more effective when students are actively engaged in the learning process. In this approach, direct instruction and frontal lessons are very minimal. Instead, learning occurs through discovery and active participation in learning experiences, where students discuss and reflect on what they experience to construct knowledge.

Collaborative and cooperative methodologies understand knowledge as a social construct. Therefore, educational activities focus on interaction, social exchange, and working together in small teams to support each other and collaborate in achieving goals.

Dialogic learning takes place through dialogue and discussion. Here different people present varied arguments and points of view. When discussing and reflecting on these ideas, new knowledge is created. The role of the teacher shifts from being a guide to being a facilitator, providing a space for students to carry out their learning activities.

Inquiry-based learning puts students at the center of the learning process; they ask questions and find the resources to answer them. The teacher acts as a supporting figure available to guide students through their process while leaving them the space they need to decide what path to choose. Learning focuses on investigating an open question, problem, or challenge and using reasoning and problem-solving skills to reach a solution.

Problem-based learning uses real-world problems to promote learning theoretical concepts. It encourages the development of problem-solving and critical thinking skills by analyzing the problem and then discovering and proposing solutions.

The flipped classroom moves frontal theoretical lessons from the classroom to the individual learning space, dedicating time inside the classroom for group activities, discussion, and interaction, to apply the previously studied concepts. It allows students to learn at their own pace, reviewing the material as many times as needed.

Blended learning is a strategy for teachers looking to introduce flexibility into their classrooms through technology. Part of the learning experience takes place in person inside the classroom, and another part is carried out online, using e-learning software. It is often combined with the flipped classroom to create flexibility and personalization for each student.

In differentiated instruction, teachers modify content and learning experiences to meet individual or small student groups' needs. It deals with the variance among learners, looking to create the best experience for each one of them.

Experiential learning, as described by Kolb in 1970, defines learning as a reflection on doing. It makes learning a more involved experience, where learners make discoveries and experiments with knowledge firsthand. However, real knowledge is not acquired just by repeated practice; through reflection on learning experiences, an exchange of ideas and perspectives occurs, and knowledge is constructed.

Academic Disciplines

According to the Theory of Knowledge (International Baccalaureate Diploma Program, 2015), knowledge "refers to awareness of or familiarity with various objects, events, ideas, or ways of doing things." This awareness is constructed when interacting with our environment, and it is how we start understanding the world that surrounds us. This type of knowledge is personal; however, when people interact and compare their knowledge, they create common structures and means to perceive and communicate collectively what they have observed.

Shared knowledge —with the pass of time and the development of societies— becomes systematic and organized; structures are created to verify it and share it with others. Universities are some of these systems created to oversee the advancement and transmission of knowledge. This knowledge is subdivided into disciplines to standardize and catalog academic work. Disciplines are defined by their epistemological characteristics like concepts, methods, and goals and by the community that develops around them, with their particular characteristics and points of view. (Becher, 1994)

Biglian (1973) classifies disciplines in two dimensions. The hard-soft axis identifies the degree to which a paradigm exists, and the pure-applied axis is concerned with the degree of application. This structure creates a diagram that helps us understand how disciplines are classified and, as a result, how courses of these disciplines are usually taught.

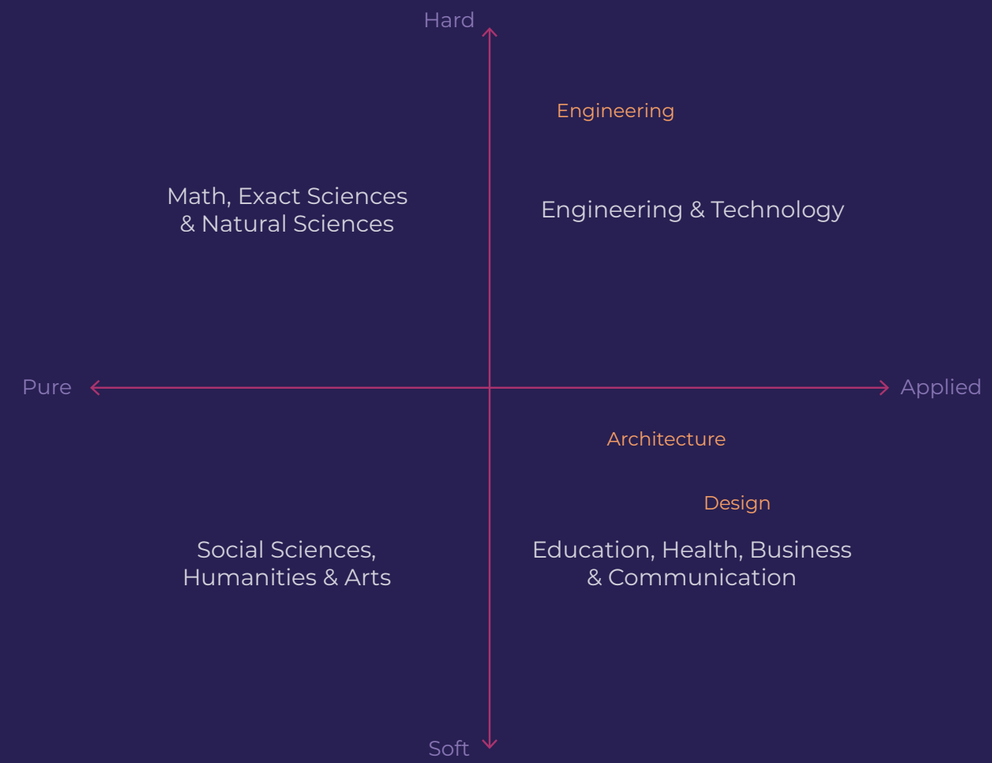

Figure 3: Classification of disciplines according to Biglian

Hard disciplines include math, natural and exact sciences, and technology-related fields such as engineering. They view knowledge as objective and absolute, based on quantitative data to create precise theories. This epistemological stance creates a fixed knowledge base for the discipline that makes teaching relatively straightforward.

Teaching, on hard disciplines, focuses on developing problem-solving and practical skills and emphasizes mastery of content rather than discussions. Because knowledge transfer occurs by retrieving generalizations or principles that apply to multiple cases of the phenomena being studied, classes are often based on lectures and workbooks, and examinations are usually based on specific and closely focused questions.

On the other side of the spectrum, we have soft disciplines such as social sciences, arts and humanities, education, health professions, business and economics, and communication. In these fields, knowledge is regarded as subjective and relative; it is constructed mainly through discussion and is open to interpretation and debate. In addition, knowledge bases of soft disciplines are less fixed because they are constructed through the study of individual cases, making knowledge go out of date very quickly.

Due to this, situated learning is very common, often through exploration and discussion of personal experiences. Teachers use discussion as the primary instructional strategy and tend to emphasize deep learning and student development. They are more likely to use active learning techniques, value diversity, and have contact with students. Evaluation guidelines are typically ambiguous because the outcome depends on the learner's context and interpretation.

Pure disciplines include sciences, both natural and social, which focus on knowledge creation and acquisition. They concentrate on theories of science and predictions that help understand the world better. Applied disciplines deal with solving practical problems and generally employ empirical methodologies. Teachers attach importance to knowledge application and integration, which often leads to courses including laboratory-based experiments, work-based learning activities and requirements, and at least some learning and assessment in the workplace.

However, "the line between pure and applied disciplines is a thin one" (Feibleman, 1961) because they are so connected to each other, often knowledge of pure disciplines comes from nature and real-life applications, while applied disciplines need theories and methods of pure disciplines to get practical things done (McGrath, 1978). On the other hand, boundaries between hard and soft disciplines are more defined, especially in academic environments. To overcome this division, multidisciplinary and transdisciplinary approaches offer spaces where different disciplines can discuss and work in projects requiring diverse viewpoints and knowledge bases.

The Future of Education

Education has been the way for communities to share and pass knowledge to the next generation, and thus, students have had to learn by memorizing a significant number of facts and data to recall information at a moment's notice and elaborate on it. In our current time, thanks to technology and an information economy, it is easier than ever to access vast amounts of information anywhere, in almost no time at all. This possibility changes the requirements of education; it no longer needs to center on transferring knowledge across generations and can start focusing more on ways to understand and analyze information to use it. (Gual Soler & Dadlani, 2020)

Additionally, the world is moving and changing faster than in the past, making it very difficult for educators and communities to predict the future direction of the world. Young people need to be prepared for currently non-existent jobs, solving problems that we cannot imagine or prepare for right now, with technologies that will change learning and the work environment in ways we cannot predict. This changes the skills students need to acquire in educational settings, from specific and procedural ones to comprehensive abilities that allow them to keep learning to better adapt to different situations. (Organisation for Economic Co-operation and Development et al., 2018)

The focus of education needs to change from memorizing and repeating facts and concepts to self-directed learning, where students find what interests them and follow their curiosities to explore different topics and projects where they develop 21st-century skills. To do so, they need to understand the problems of their time and analyze them, understanding the possible consequences and ramifications. They then have to gather information, classify what is helpful for the situation and synthesize new knowledge. Finally, they need to be creative and work with others to solve problems and create solutions. As summed up by the OECD 2030 Future of Education and Skills Project: "We need to replace old education standards with an educational framework that combines knowledge with the 21st-century skills of creativity, critical thinking, communication, and collaboration."

Creativity is a valuable skill in a constantly changing world where past solutions are not useful for future problems. Therefore, students must develop creativity to use, mix, and improve the vast amount of knowledge and ideas collected by humans through time. Project-based learning is one of the strategies that bring out the creativity in students by confronting them with real situations where there is no definitive answer but rather a space to explore and try.

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Other essential skills of the 21st century are curiosity and critical thinking, which —when encouraged and developed— strengthen the analytic and inquisitive brain, vital for decision making and societal development (Boyce, 2019). Critical thinking is crucial when the amount of information is massive to discern what is truly important, useful, and true. Students must ask profound and important questions to arrive at conclusions that they can support with their own arguments.

Collaboration is critical in a future where problems are very complex and require an interdisciplinary approach. With their experiences and background, each person brings to the table diverse knowledge and perspectives that, when confronted with

others, allows for a much more complete view of the problem and a wider variety of solutions where people can join forces. These can be achieved when high-quality education becomes widely available, regardless of social or economic disparities. Here, communication skills are essential to connect with people who are not experts in particular topics or have different knowledge bases. Through good communication, information becomes accessible to more people, and a greater understanding can be achieved to work together.

In addition to connecting with diverse people, contact with the natural environment is one of the most critical ways education needs to move forward. To expand the sources of knowledge and inspiration, a deep connection with nature needs to flourish in students. In conjunction, a sense of social responsibility to create solutions that reduce inequality, promote the betterment of society, and are inclusive for all may be the solution to many of our systemic problems, as well as a new path to healing ourselves and our relationship with the world that surrounds us.

POLITECNICO
DI TORINO

Photo by Italy Where

Politecnico di Torino is one of the most important public universities in Italy and Europe concerning education, research, technological transfer, and services for engineering, architecture, design, and planning.

The university started its activity at the beginning of the twentieth century, following the growth of industrial activity in the country, seeking to bring research and higher education to technical studies. However, learning at Politecnico di Torino goes far beyond technical knowledge; it means acquiring the skills necessary to face changes and managing the interdisciplinary nature of the world to help solve the most pressing problems and questions of our time.

The Politecnico has three core missions: to innovate in education at the service of society, create and share knowledge, and generate a significant impact on society. To do so, the university has forged strong relationships, both with the European scientific world and with the local and national industry, creating a regional network of technological centers dedicated to specialist education and research.

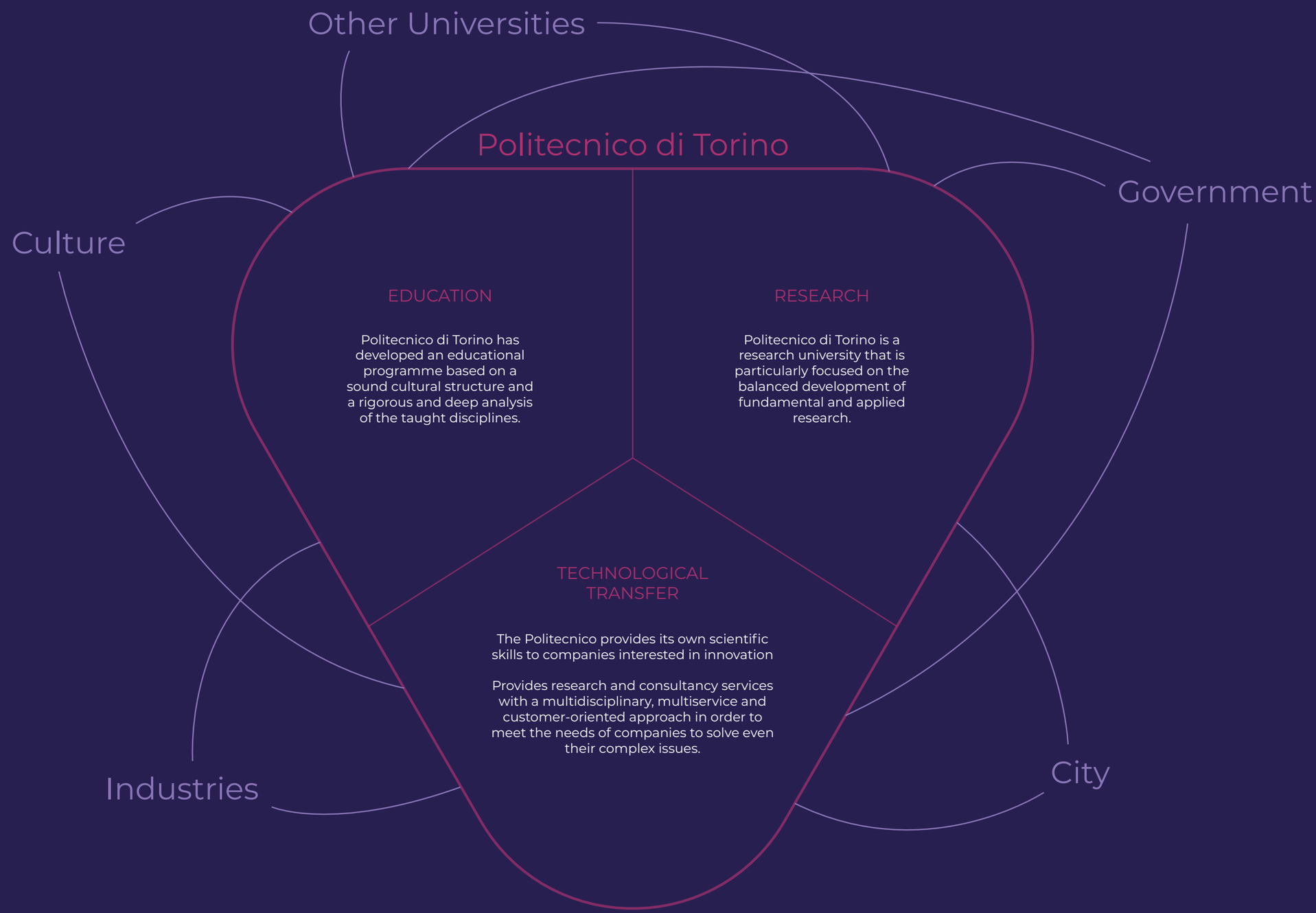


Figure 4: The three core missions of Politecnico di Torino and their connections with external actors

Pedagogy in PoliTo

Education in Politecnico di Torino is divided into three departments, engineering, architecture, and design. Each of these disciplines has a particular epistemological background and practices; however, they are also interconnected, share areas of knowledge, and often work together to develop complex projects. Therefore, some pedagogical methods are unique to the discipline, while some are similar given the shared context and practices.

Photo by Samuele Giglio for Unsplash

After reviewing the diversity of courses offered by Politecnico, both in Triennale and Magistrale degrees, the following analysis of the teaching methodologies was constructed.

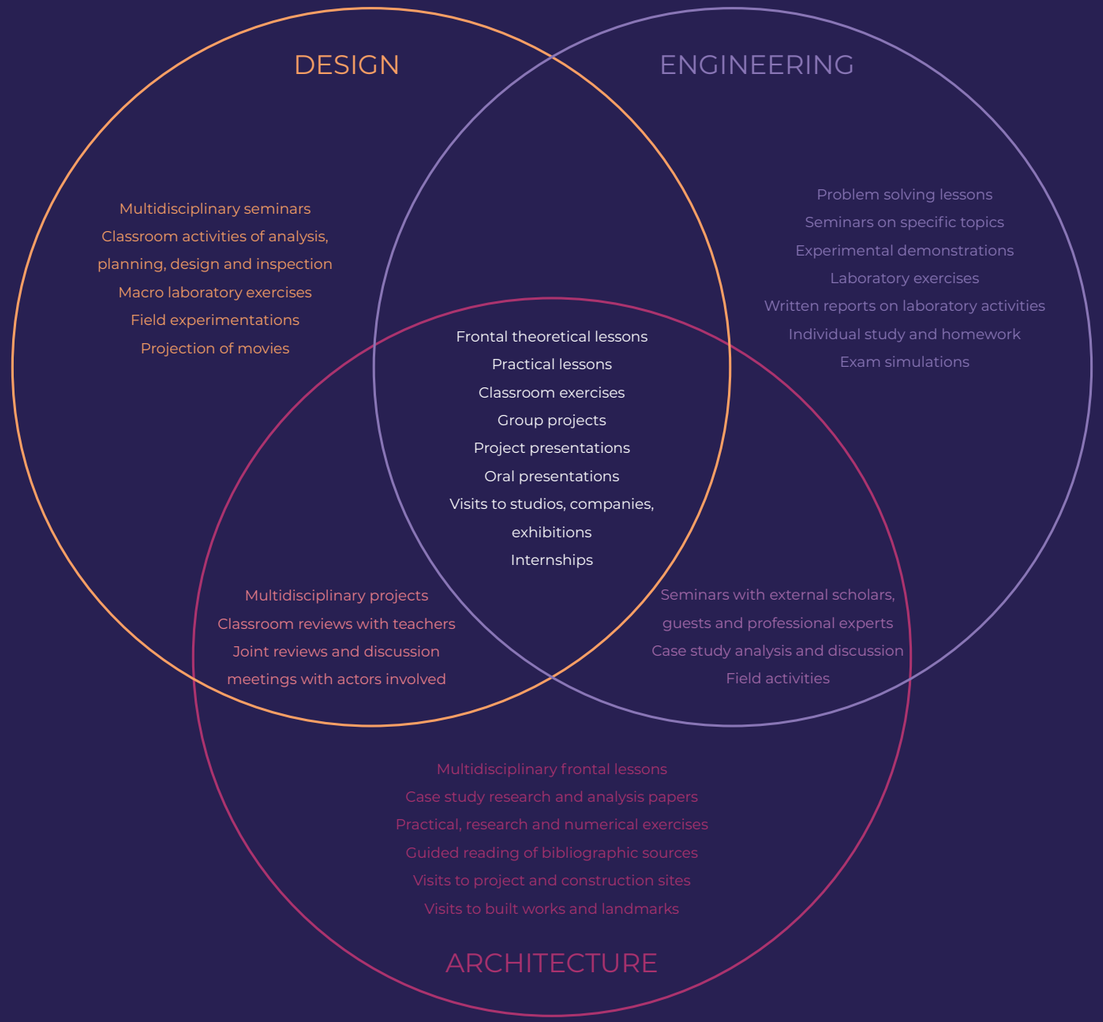


Figure 5: Teaching methodologies used in Politecnico di Torino - Lessons

All three disciplines use traditional teaching methods such as frontal lessons while including more practical exercises and group projects that make lessons more dynamic and collaborative. Additionally, in most programs, we can see activities with external

actors like visits to studios, companies, and exhibitions or internships, that promote work-school relationships and skills.

Architecture and design share methodologies such as multidisciplinary projects that require reviews with teachers and external actors. These correspond to soft discipline's methods that consider the context of learning experiences and open spaces for exploration and discussion. On the other hand, engineering and architecture have seminars and case study analysis activities that refer to the creation and acquisition of knowledge, which shows their strong relationship with pure sciences that back theories and concepts used to develop projects later on. Finally, according to the study plans for design and engineering courses, these disciplines do not share any particular learning methodologies in Politecnico.

Furthermore, we can observe the nature of each of the discipline's lessons methodologies by the activities unique to them. For example, engineering lessons focus on laboratory activities and experimental demonstrations with reports covering what has been observed and analyzing what can be learned when applying theoretical concepts. There is also a noticeable emphasis on individual study, homework, and evaluations that is not as present in the other disciplines. Architecture lessons stand out for their attention to research; by reading bibliographic sources, visiting landmarks and historical buildings, and writing case study analyses and research papers. They also show a connection to the territory, visiting built works and construction sites. Finally, design lesson activities highlight the experimental and practical learning approach present throughout the discipline's courses.

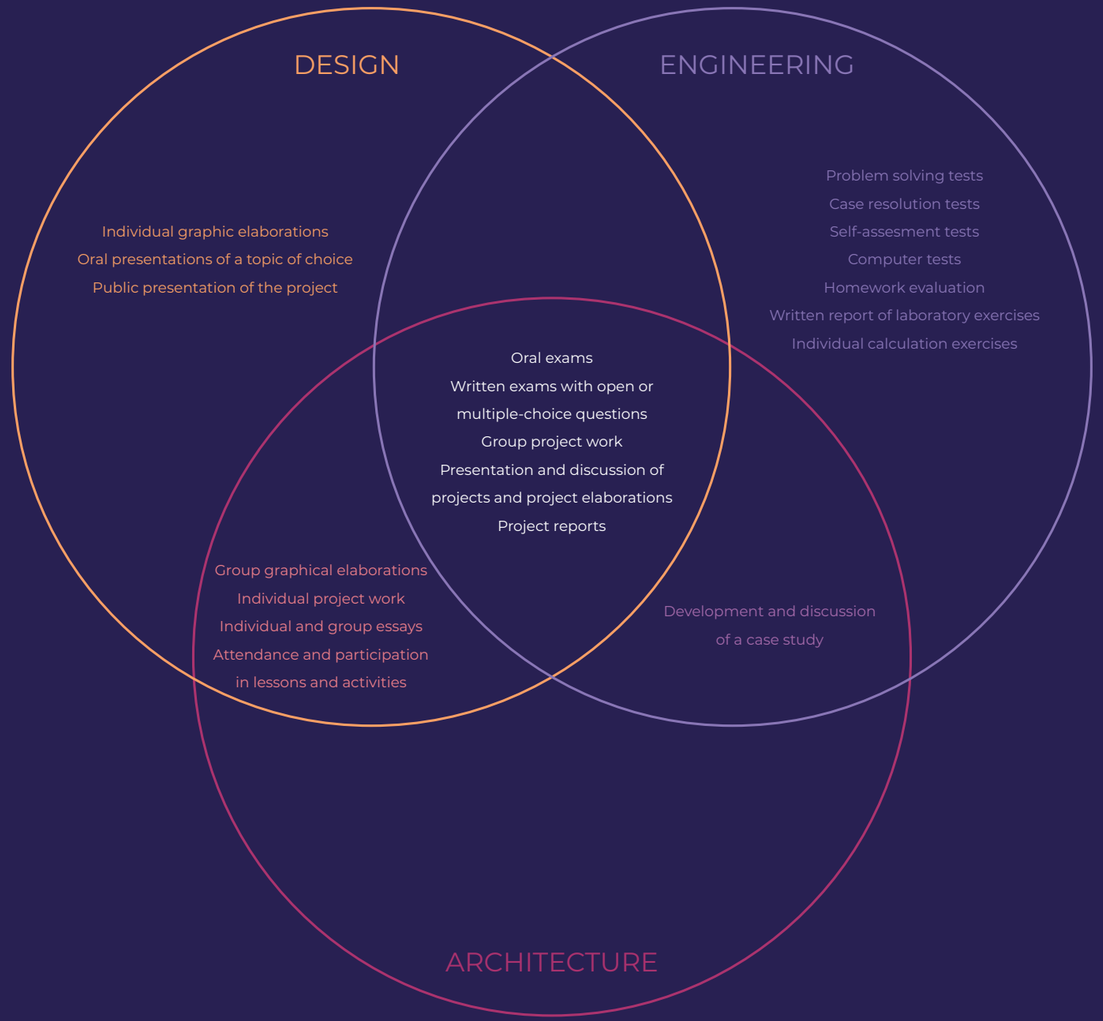


Figure 6: Teaching methodologies used in Politecnico di Torino - Evaluations

Evaluation methods reflect the learning activities and the pedagogical approaches of each of the disciplines. For instance, all three disciplines have traditional evaluation methods in common that correspond to traditional activities. These include oral

and written exams with open or multiple-choice questions. On the other hand, we have presentations and discussions on student's work and projects which encourage a more dynamic and subjective evaluation.

Engineering evaluation is primarily centered on testing. Depending on the topic and activities developed in class, there are different types of tests, but they focus mostly on individual problem-solving exercises. There is also group evaluation in laboratory reports in which all students need to participate and work together to succeed. The latter corresponds to the application of knowledge that is very important in disciplines in the engineering field.

Architecture and design share most of their assessment techniques and methodologies. Evaluations focus on reviewing the work presented by teams to explain their process of developing a project and on individual projects and essays that students work on throughout the course. It is much closer to soft discipline evaluations because it focuses more on discussion and interpretation, making evaluation subjective, relative to each case presented rather than on general principles or qualitative data.

Strategic Plan 2018 - 2024

The Politecnico has constructed a strategic plan to transform the university's structure and teaching, to prepare its students for the changing world and the new skills, perspectives and relationships required. One of the main points of the strategic plan is to shift from a factory university, where education is standard and bound to knowledge of the past, to a platform for growth, innovation, connection, and the development of society. To do so, Politecnico proposes placing the student at the center of the learning process, moving away from teacher-centered learning by implementing more experiential activities, group work, and soft skills development, to help them engage with the world around them and choose the best way to intervene to generate a positive impact.

As seen previously, there are diverse teaching methodologies used in the different disciplines and courses in the university. However, to keep education moving forward and achieving results that

align with the new university model, Politecnico considers it necessary to experiment and try out teaching activities and content. These new approaches must combine teacher-centered activities with more experiential ones, involving students and making them part of their processes. They must also include project-based activities to encourage the development of problem-solving and cooperation skills. Additionally, the university emphasizes extending the skills developed to include more soft skills that allow students to assess the space surrounding them and their impact on it.

To implement these changes without harming student's learning processes, Politecnico has created a Learning Centre and a Teaching Lab to create spaces and opportunities for teachers to share their knowledge and experiences and create a community that supports the teaching process and experimentation in the field. In addition, each department is invited to create an educational innovation plan that, supported by the Teaching Lab, will help develop the educational strategies and methodologies for each of the university's courses.

Photo by Politecnico di Torino for Learning Center Masterplan

In conjunction with the Strategic Plan, there is a Master Plan that projects the spaces that will need to be created for the new growth and innovation to occur. It focuses on planning for new space configurations for the possible future, allowing innovation and sustainability to develop.

One project that particularly encourages innovation and flexibility in teaching methodologies is the Aule 6C-6D, where traditionally constructed classrooms for frontal, traditional lessons are reconfigured to allow for experimental teaching activities. The project focuses on creating elements that allow adaptability to both individual work and teamwork, as well as to traditional and creative teaching methodologies. In addition, these elements need to be easy to transform, maintain and scale, making them simple and economically feasible to implement in as many classrooms as needed.

Other projects that consider new ways of teaching and learning include Torino Esposizioni and the Learning Center. The first one takes a public cultural space and redevelops it to create a place for students and citizens to gather. The redesign proposes constructing flexible and modular spaces that support learning, connection, and culture creation. It includes furniture and elements that can transform depending on the proposed learning activities or events on the premises. On the other hand, the Learning Center concentrates on the renovation of spaces for innovative uses, such as creating new course structures and collaborating with private and institutional actors, all within a space that encourages creation and experimentation.

Teaching Lab

The Teaching & Language Lab was inaugurated in April 2019 as a space dedicated to innovative teaching that guarantees a high level of education to serve students in their learning processes. Its main objective is to create a strong community of professors to collaboratively develop the programs outlined in the strategic plan. As explained by Sebastiano Foti, the vice-rector for education, “we are working so that the Teaching Lab can become the aggregation center of a community that wants to confront and grow.” The community serves as a space to share teaching methods and practices so that innovation is boosted and moved forward collaboratively.

Additionally, the activities that take place in the lab open opportunities for teachers to solve doubts and difficulties teachers might be having with their teaching approach and would not be comfortable sharing in more informal settings. This process might even result in the creation of strategies and guidelines to design new teaching methods and prepare new teachers to teach. All in line with what the university wants, according to the university’s rector, Guido Saracco, “to give our teachers the tools to continuously improve themselves in their fundamental teaching mission.”

Another vital purpose of the Teaching lab is to serve as a hub for connections with other education laboratories, universities, and experts that may nourish the community with knowledge, ideas, and relationships to support exploration and learning amongst teachers.

As seen on the strategic plan of Politecnico, one of the projects meant to support the work developed in the Teaching Lab is the creation of a physical space where new teaching and learning approaches can be tested out —a place flexible and dynamic enough to adapt to the different activities and methodologies that teachers want to experiment with.

In its initial phase, the lab organized a series of workshops meant to build community and discuss topics relevant to them; topics like holding courses in English that are effective and comprehensible, presenting learning tools available through the university, and designing active and participatory learning methods in presence and online. However, the lab was always outlined to be both a physical place and a virtual one. With the global pandemic, most of the lab’s activity moved online to a Slack channel, where a more dynamic community started collaborating to respond to the new challenges that online teaching presented. This situation accelerated the creation of digital spaces to share resources with teachers to aid them in their work and encourage exploration and experimentation of new forms of teaching.

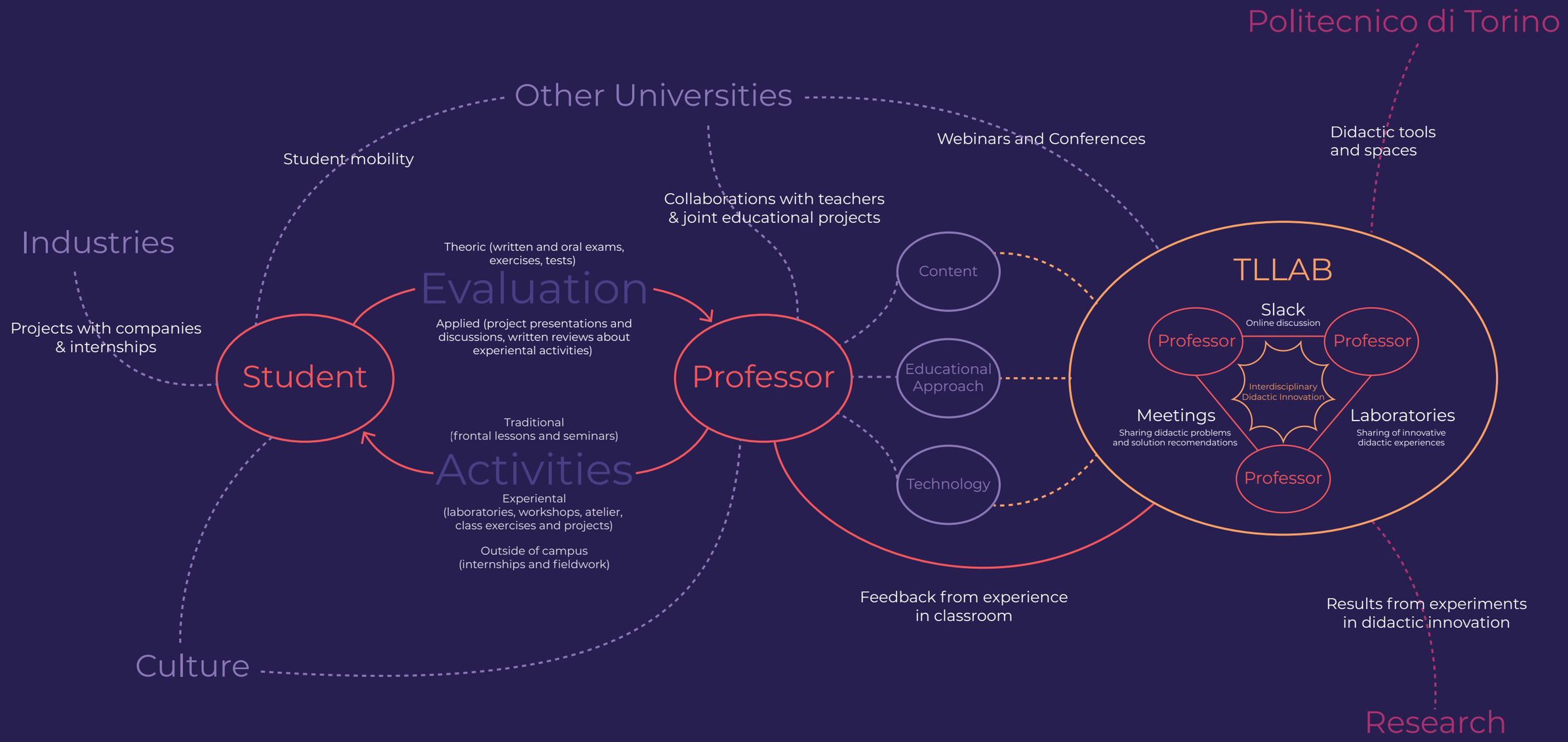


Figure 7: Education system in Politecnico di Torino explaining the relationships between TLlab, teachers and external actors

DESIGN ANALYSIS

Photo by RF Studio for Pexels

A learning experience “refers to any interaction, course, program or other experience in which learning takes place.” (Great Schools Partnership, 2013) Traditionally, it may look like a course in a school or classroom; however, the academic vision of learning has been expanding and diversifying in recent years. This transformation means that teachers and institutions are starting to consider non-traditional methodologies —including informal learning— or new learning technologies and settings. Hence the use of the word experience because educators are acknowledging the interactions and elements that influence the student’s learning process even outside of the course program.

Due to this shift in perspective, an exciting opportunity arises to think about education through the experience design process. A new discipline called Learning Experience Design does just this; it combines the tools for course construction from instructional design with the user-experience focus of UX design. This approach results in a more holistic learning experience that is engaging and enjoyable for students while maximizing knowledge retention and skill acquisition.

Given the human-centered approach of UX design, the first step when creating a learning experience is to get to know and understand the learners, which means recognizing their motivations and interests, getting to know their knowledge and skills, and understanding what they need to obtain from the experience.

Course Structure

Design education is project-based; its main objective is learning to apply methods and knowledge to solve problems. It takes a constructivist approach where students integrate their mental models, skills, and knowledge from previous courses, experiences, and areas of expertise to construct and elaborate ideas and develop their professional skills. These characteristics are seen in the curriculum of Politecnico's design courses. The structure of a course includes some theoretical lessons; however, the main focus and time are given to analysis, design, and verification activities.

Most design courses have theoretical lessons —particularly at the beginning of the term— to introduce the course's topic and methods. Theoretical lessons might continue in parallel classes to give students additional knowledge and points of reference to work with. Ideally, the course structure is created so that parallel classes and the topics covered complement the main program.

Nevertheless, given the design education approach, knowledge application is essential, and it is usually done through the execution of a class project. These projects are frequently carried out in small groups. Firstly, this enables acquiring teamwork and collaboration skills, which are very important for designers and future thinkers. Additionally, having more people working on one project provides the conditions to discuss, exchange ideas, and consider new perspectives, resulting in a more complex and elaborate final product.

Photo by Fox for Pexels

A fundamental class activity is the design review, to support students in the project development process and assess their work. They constitute moments of collective discussion, negotiation, and inspection. On projects with external actors involved, reviews are the spaces for consultation and observation that may lead to the implementation of the project. Reviews are also great pedagogical tools because they serve as opportunities to exercise the ability to present with clarity and effectiveness, a necessary skill in the workplace. Due to their discursive and trial-and-error nature, reviews take up most of the time available in the classroom.

Design reviews are accompanied by general discussions of topics of relevant interest to support teams through the design process. In addition, these spaces serve as opportunities for readjustment and enrichment.

All the work done throughout the course concludes in a final presentation and evaluation. This activity is a necessary component in academic settings because it provides a way to assess if the learning process has been successful and the desired outcomes can be observed in the students' work. Most design courses have a team of teachers, reviewers, or clients that assess the validity and quality of the work done by students. Apart from giving a passing or failing grade to the course, this activity prepares students for work with real clients and demands.

Reviews

As seen in the analysis of the current structure of design courses, design reviews take up most of the time spent in the classroom due to their importance in the design process and the opportunity they present for teachers and students to discuss, share ideas and confront their perspectives.

Still, reviews are a vital activity not just for design but for the entire academic world. They are the way contributions to a field of knowledge are assessed and valued. A review is an opportunity for authors to present their work and explain why their findings are new. Reviewers assess the work, offer their honest opinion, and respond to each other's ideas. In addition, they determine the validity, significance, and originality of a piece of work.

Academic reviews take place when a piece of work is up for publication. Depending on the situation, they can be editorial reviews or peer reviews. Editorial reviews are predominantly used in non-research settings like book publications or opinion articles. Here, a member of the editorial staff of the publication house or magazine is paid to review the work. They determine whether the

piece fits the line of the publication while checking for mistakes and inconsistencies. On the other hand, peer reviews are common in research spaces. In this case, reviewers are scholars of the same field who use their experience in the area to assess the work presented and decide if it is relevant and correct.

Because reviewers provide suggestions to authors on how to improve their work, they are essential to ensuring that a certain level of quality is achieved and that errors are not published. Furthermore, reviews force researchers to think deeply about their work and how others might understand it. This process ensures that the information communicated can be trusted while the study field remains current and updated. In this way, science and other disciplines have grown and maintained their integrity through the years.

In design, reviews are a space to revise and discuss the project's progress, evaluating if the decisions taken align with the design requirements and goals. Depending on the project's needs and the design team's goals for the meeting, they take different forms and shapes but are usually done in a collaborative and dynamic setting. Designers present their work and concerns while stakeholders provide feedback and new perspectives. They are a handy tool to optimize a design process by identifying areas for improvement and gathering advice. In addition, reviews allow designers, clients, and management to communicate and make sure their visions align to set priorities for future work.

In a design course, different activities and methods can be used to discuss and revise the work developed by students. In Politecnico's design courses, the current review structure is one where each team of students presents their work to the teacher and the assistants who give back feedback and resources to improve the project and guide teams in their processes. The structure is shaped by how professional design reviews work, where teachers assume management's role in businesses. However, they are also influenced by academic editorial reviews, where a paid professional determines the validity and correctness of the work presented.

Reviews can be private, where the group sits with the teacher, shows their work, and discusses the next steps they should take, or public, where each group gives a presentation in front of the whole class to receive feedback. Private reviews allow for deeper discussion, more opportunities for teams to ask questions, and get more detailed feedback. However, given that there usually is only one teacher and sometimes a couple of assistants per class, it takes a long time to review every group, and the flow of information is very limited, reliant on only one person; the teacher.

On the other hand, public reviews open the discussion to the whole classroom, allowing students to follow their classmates' progress and exercise their presentation skills. Unfortunately, when the discussion is opened to so many people, without clear directives, it is unusual for students to participate or give feedback to their classmates, so the comments received tend to be fewer and more general than in private reviews.

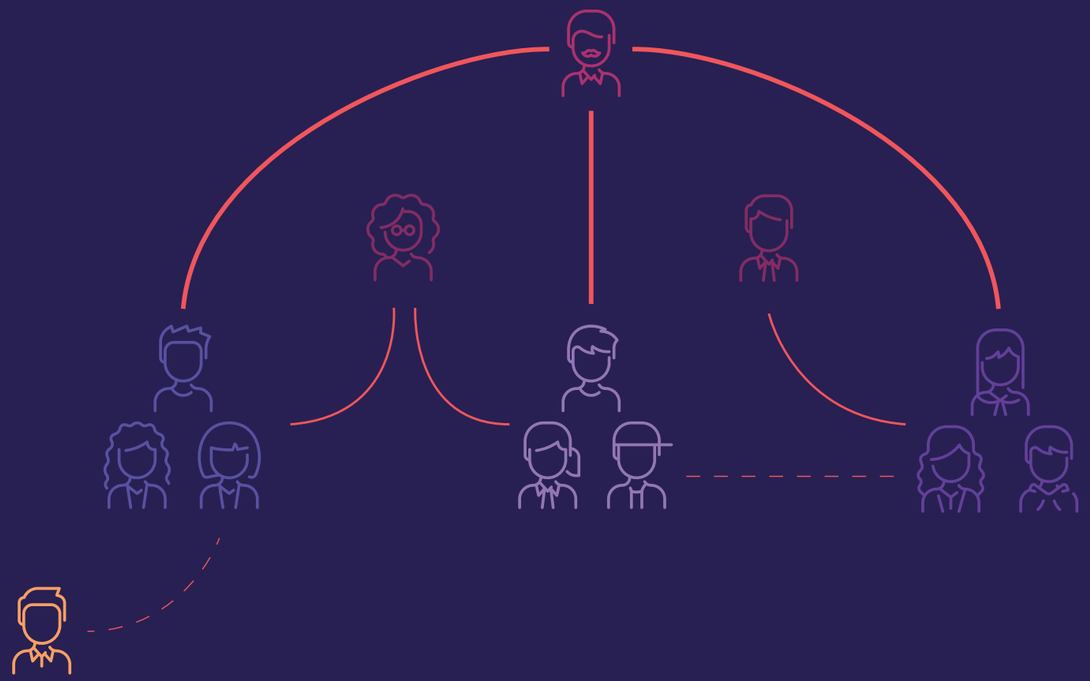


Figure 8: Current review structure

This review structure results in a hierarchical dynamic where each team relies on the teacher for guidance and observations, and interactions between students depend on their connections and social skills. Students who are very social and know people in other teams or upper classes can develop a network to understand better the work that others have done and compare it to their own to recognize what they need to do and how others can help them. However, those who have not had the opportunity to create these support systems depend on the teacher as their only reliable source of feedback.

User Analysis

Personas is a tool used to present the observations and information gathered in user research. First described by Alan Cooper in his book *The Inmates are Running the Asylum*, personas are fictional characters with specific and individual traits representing a user model that appears as patterns during research. They are used to synthesize research and give a visible dimension to human behavior.

This approach will be used to empathize with users, comprehend what they seek in a design course, and identify their needs. Given the duality of the education experience, some personas will represent teachers while others represent learners, which will allow us to understand both sides of the experience and evaluate solutions that benefit all of them.

Marco Bigliani

Continuing

Age 23

Location Torino, Italia

Education Triennale Design
Politecnico di Torino

Bio

Marco recently finished his bachelor's in design at Politecnico di Torino and has decided he is interested in continuing his path in academia. He likes the idea of one day working as a teacher and researcher for a university to make his contribution expanding and enriching the field of design. To do so, he thinks the best way would be to complete his master's degree and then continue his education, embarking on a doctorate. That will allow him to focus on his research while working as an assisting tutor for a professor to learn how to manage a classroom, prepare lessons, and everything that comes with the job.

Personality

Extrovert — Introvert

Sensing — Intuition

Thinking — Feeling

Judging — Percieving

Goals

Learn as much as he can about design to find the area that he wants to explore with his research.

Hone his leadership and communication skills that will serve him in his career path.

Make solid connections with other students, assistants, and teachers, which will support him as he moves forward in academia.

Frustrations

Puts a high value on his peers' and professor's opinions, so when information is conflicting, it makes him doubt himself.

Is still developing his leadership and collaboration skills which makes it hard to work in groups smoothly.

Wants to collaborate with everyone and does not find the spaces or tools to do so.

Motivations

Acquiring design knowledge

Aquiring soft skills

Networking

Socializing

Caterina Gasparini

Working

Age 27

Location Chieri, Italia

Education Triennale Design
Politecnico di Torino

Bio

Caterina graduated from Politecnico di Torino and through her internship, she landed a job in which she excelled and quickly advanced, which has made her very happy. Now, she and her superiors think it would be valuable for her to continue her studies to gain specific skills which would enrich the companies processes and tools. Throughout this, she needs to skillfully manage her time so she will be able to keep up her responsibilities at work while dedicating herself to her studies. Caterina hopes her effort will earn her a promotion to keep advancing her career.

Personality

Extrovert	Introvert
Sensing	Intuition
Thinking	Feeling
Judging	Percieving

Goals

Gain knowledge and tools to move ahead in her career.

Improve her problem-solving and design application skills to make her remarkable in her work.

Complete her master's degree to get a promotion in her workplace.

Frustrations

Has limited time because she has to divide it between work and school responsibilities.

Finds many meetings and presential work to be time-consuming and unnecessary.

It is hard for her to integrate with her classmates, given their different schedules and responsibilities.

Motivations

Acquiring design knowledge

Aquiring soft skills

Networking

Socializing

Giancarlo Zunino

Specializing

Age 24

Location Savona, Italia

Education Triennale Architettura
Università di Genova

Bio

While studying architecture at Università di Genova, Giancarlo was very interested in sustainability. Upon graduating, he decided to pursue this area of interest by continuing his education in Politecnico di Torino. He feels this master will give him the tools and knowledge to understand sustainability problems and provide solutions from the design perspective. It has also been an opportunity for him to know different learning approaches and subject matters to increase his odds to obtain a great job.

Personality

Extrovert — Introvert

Sensing — Intuition

Thinking — Feeling

Judging — Percieving

Goals

Expand his area of knowledge to increase his critical thinking and problem-solving skills.

Specialize in the course's topics to gain a better understanding and be able to apply the concepts.

Graduate with the best grades to get a great job in which to make a difference.

Frustrations

Is still developing his leadership and collaboration skills which makes it hard to work in groups smoothly.

Has academic experience in a different field which makes him doubt his strengths and knowledge when working with people who have coursed their entire academic career at Polito.

Motivations

Acquiring design knowledge

Aquiring soft skills

Networking

Socializing

Julia Garcia

Erasmus

Age 20

Location Ciudad de Mexico, Mexico

Education Triennale Design
Universidad Nacional
Autonoma de Mexico

Bio

Julia is studying design at UNAM, but she has always wanted to visit Europe to explore its cultures and people. She stopped by the university mobility office and found out about an exchange program with Politecnico di Torino, so she immediately applied and started learning Italian. It is quite a new experience for her, being far away from home and in a completely different culture. She wants to make the most of her year abroad by traveling, getting to know lots of people, and learning design in new ways.

Personality

Extrovert — Introvert

Sensing — Intuition

Thinking — Feeling

Judging — Percieving

Goals

Experience new cultures and get to know people from different places.

Explore different ways of learning and working in design to expand her knowledge of the discipline.

Acquire skills and knowledge that are not available at her home school.

Frustrations

It is hard for her to focus on schoolwork when there is so much to experience while being abroad.

Given her different academic and cultural background, she is not always sure of the way things are done and is embarrassed to ask others to explain it.

Motivations

Acquiring design knowledge

Aquiring soft skills

Networking

Socializing

Luca Osti

Professor

Age 46

Occupation Professor at Politecnico di Torino

Bio

After graduating, Luca worked in the industry for a few years before realizing how much he missed academia and how many opportunities it offered. Now, he has been working as a university professor for 15 years. Luca loves exploring the possibilities that design has to offer other disciplines and companies, so he spends a lot of time on his research and is in contact with designers of different fields through his participation in numerous design organizations. But the part of his job that he likes the most is creating spaces for his students to develop their skills while exploring the learning possibilities that the design process reveals.

Personality

Extrovert — Introvert

Sensing — Intuition

Thinking — Feeling

Judging — Percieving

Goals

Guide his students on their learning process and prepare them for the future.

Provide support for teams on their projects to help them do the best work possible

Develop the design discipline through research and sharing knowledge with others.

Frustrations

Has many responsibilities, including research, lesson planning, lessons, meetings, that take time and resources.

Has to coordinate teachers, assistants, guests, and students and keep everyone up to date on the class' progress and status

Changing his course's structure would be time-consuming and uncertain.

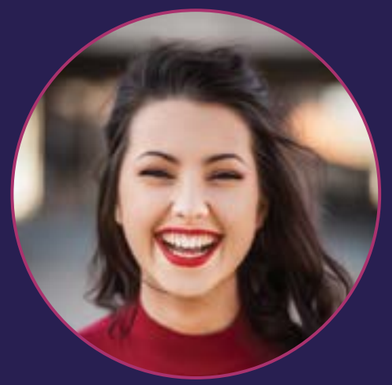
Motivations

Sharing design knowledge

Improving teaching skills

Expanding design discipline

Collaborating in projects



Elena Monti

Assistant

Age 29

Occupation Doctorate student at Politecnico di Torino

Bio

While completing her doctorate at Polito, Elena has become interested in helping other students learning processes by using her experience and research. So, she decided to work as an assisting tutor for professor Osti where she has learned so much about creating and managing a class. She has also discovered she likes to help others find possibilities to explore in their projects to create great things. This experience has also opened the opportunity for collaboration in her doctorate thesis, which is exciting.

Personality

Extrovert — Introvert

Sensing — Intuition

Thinking — Feeling

Judging — Percieving

Goals

Share her experience and knowledge with younger students so they can explore new perspectives in their projects.

Help the professor manage his course while improving her teaching skills.

Discover opportunities and applications for her research in the classroom projects.

Frustrations

Has several responsibilities to balance, \that she has to adjust around the professor's schedule.

Is not always confident enough to express her opinions and relies on the professor to know when to do so.

Has difficulty remembering every team and the work they are doing.

Motivations

Sharing design knowledge

Improving teaching skills

Expanding design discipline

Collaborating in projects

Bruno Consoli

Guest

Age 39

Occupation Strategy director at Studio Design

Bio

Bruno has been working for a long time and is now a director at a big design firm. He is also part of a design organization that brings together industry and education. There, he met Luca, and they have since become close friends. So, when he told him about his students' projects, Bruno thought it was an excellent opportunity to reconnect with the academic world. They have decided he will give a couple of conferences to Luca's class and review his students' projects. Maybe an opportunity for collaboration will arise.

Personality

Extrovert — Introvert

Sensing — Intuition

Thinking — Feeling

Judging — Percieving

Goals

Share his experience as a professional and offer a different perspective of design to students to encourage and inspire them.

Create connections with the academic world that open opportunities for future partnerships and mutual growth.

Explore students' work and open the possibility of collaborating with them.

Frustrations

Has very little time to share with students given his many responsibilities

Is not very familiar with the course structure, learning methodologies, and tools.

Is not acquainted with the class projects, so he needs guidance and additional explanation to provide relevant feedback.

Motivations

Sharing design knowledge

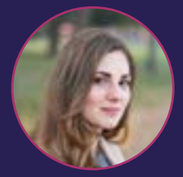
Improving teaching skills

Expanding design discipline

Collaborating in projects

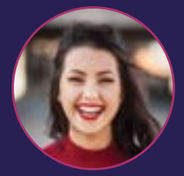
Marco Bigliani
Continuing

Luca Osti
Professor



Caterina Gasparini
Working

Elena Monti
Assistant



Giancarlo Zunino
Specializing

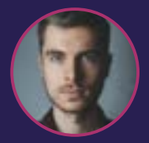
Bruno Consoli
Guest

Julia Garcia
Erasmus

Figure 9: Personas for design analysis

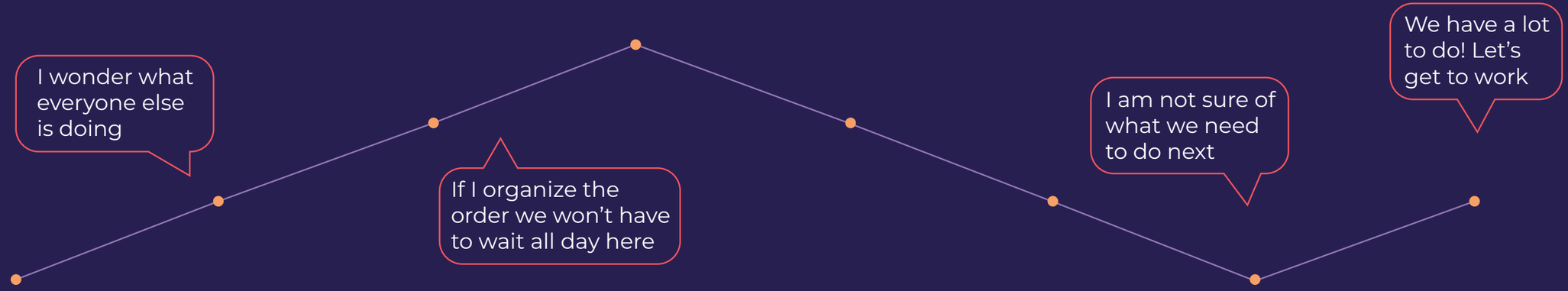
Now that we understand the different types of users present in a design classroom, *Journey Mapping* can give us a deeper look into how each of these characters experiences a design review. A journey map is “a visualization of the process that a person goes through in order to accomplish a goal” (Gibbons, 2018). It is a detailed description of the user’s interactions with the service to observe the entire experience from the user’s perspective.

“Data often fails to communicate the frustrations and experiences of customers. A story can do that, and one of the best storytelling tools in business is the customer journey map” (Boag, 2020). Journey maps are visual tools that allow us to empathize with users, identify their pain points and convey this information to other people. Here, they will help us determine what works on the current review structure and potential opportunities to improve the learning experience.



Marco Bigliani

Work at home		Class set up		Review with professor and/or assistant			After
Do work assigned in the last group meeting	Meet with group to put together the material and prepare a presentation for the review	Organize the order and procedure for the reviews	Talk with classmates while waiting for turn to present	Set up space and material for the presentation	Present work done	Recieve feedback and answer questions	Discuss feedback with group to plan what to do next



Channels to communicate with other teams to share progress, doubts, tools, and ideas to help each other without waiting for a meeting with the professor.

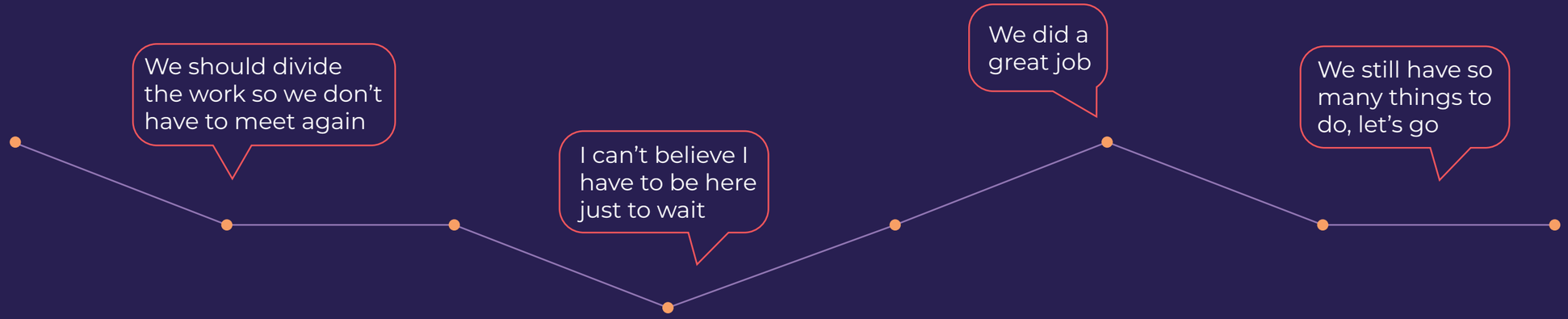
Gamification strategies that encourage proactive students to lead and help move along activities proposed by teachers.

Activities that allow groups to get suggestions and ideas from different sources and create time to discuss them to help teams find more connections and solutions for their projects.

Instruments to capture comments and make them available to every team member after the review.

Caterina Gasparini

Work at home		Class set up		Review with professor and/or assistant			After
Do work assigned in the last group meeting	Meet with group to put together the material and prepare a presentation for the review	Organize the order and procedure for the reviews	Catch up on work for other projects while waiting for turn to present	Set up space and material for the presentation	Present work done	Recieve feedback and answer questions	Discuss feedback with group to plan what to do next

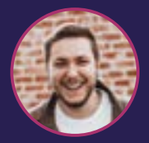


Accessible spaces and tools to keep up with what other team members are doing, share doubts and ideas without meeting up in person.

In advance organization and communication about the class activities to help students understand the program and plan accordingly.

Role assignation for the review, where everyone involved has a distinct task, so information is shared and captured more efficiently.

Tools to set up goals, tasks, and due dates to help groups manage their projects while working remotely



Giancarlo Zunino

Work at home		Class set up		Review with professor and/or assistant			After
Do work assigned in the last group meeting	Meet with group to put together the material and prepare a presentation for the review	Organize the order and procedure for the reviews	Figure out final details for presentation while waiting for turn	Set up space and material for the presentation	Present work done	Recieve feedback and answer questions	Discuss feedback with group to plan what to do next

Space to share progress, doubts, tools, and ideas with others, regardless of their role or team, to make sure everyone is on the same page and can move forward in their projects.

Class activities in which all groups are involved while being in the classroom; to make the most of their time together and make sure every group has enough opportunities to get feedback.

Tools to promote team discussions to set goals for the review that help groups present better and receive more fitting feedback.

Time allotted to discuss and analyze feedback received and decide next steps in project development.

Julia Garcia

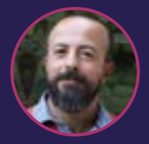
Work at home		Class set up		Review with professor and/or assistant			After
Do work assigned in the last group meeting	Meet with group to put together the material and prepare a presentation for the review	Organize the order and procedure for the reviews	Wait for turn	Set up space and material for the presentation	Present work done	Recieve feedback and answer questions	Discuss feedback with group to plan what to do next

Explanation of design methodology and project planning to help students accustomed to a particular way of designing understand different processes and what is expected of them.

Loosely structured exercises; that provide enough directives to complete classwork requirements but leave space for casual interaction, conversation, and creativity.

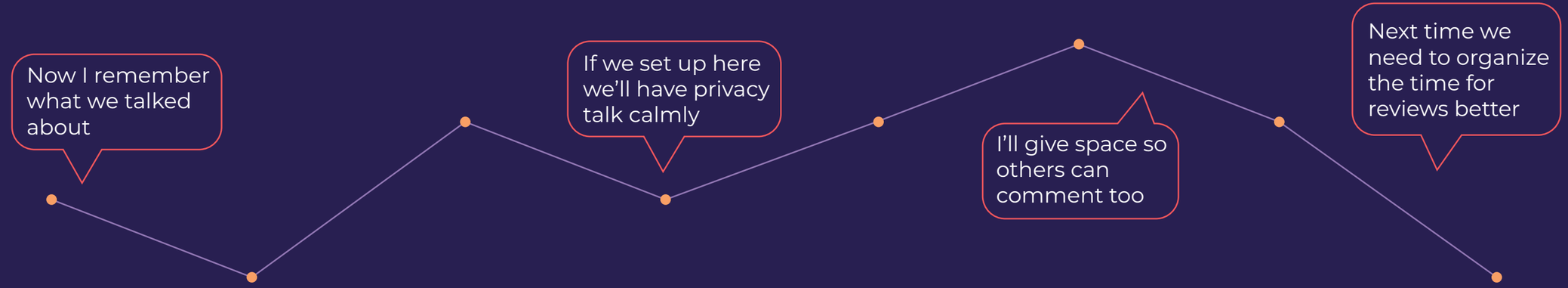
Space setup that encourages fluid communication and interaction by creating a sense of safety and privacy between its members.

Tools to review observations and set up goals for future work, planning the steps necessary to get there.



Luca Osti

Class preparation	Class set up	Reviews with groups	After
Review last week's notes to prepare for meetings with groups	Explain the day's activities to the class	Write down main points and feedback ideas while group presents	Set goals and dates for the next review
Meet with assistants and guests to explain the class program and activities	Set up space for the review while students decide review order	Give feedback and recommend useful resources	Recap the day's reviews to plan future activities and lesson topics

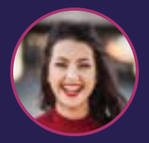


Tools to review each team's progress to date and explain the class activities based on the current situation.

Space setup that allows fluid communication, interaction, and easy rotation of groups while maintaining the conversation private and at a reasonable volume.

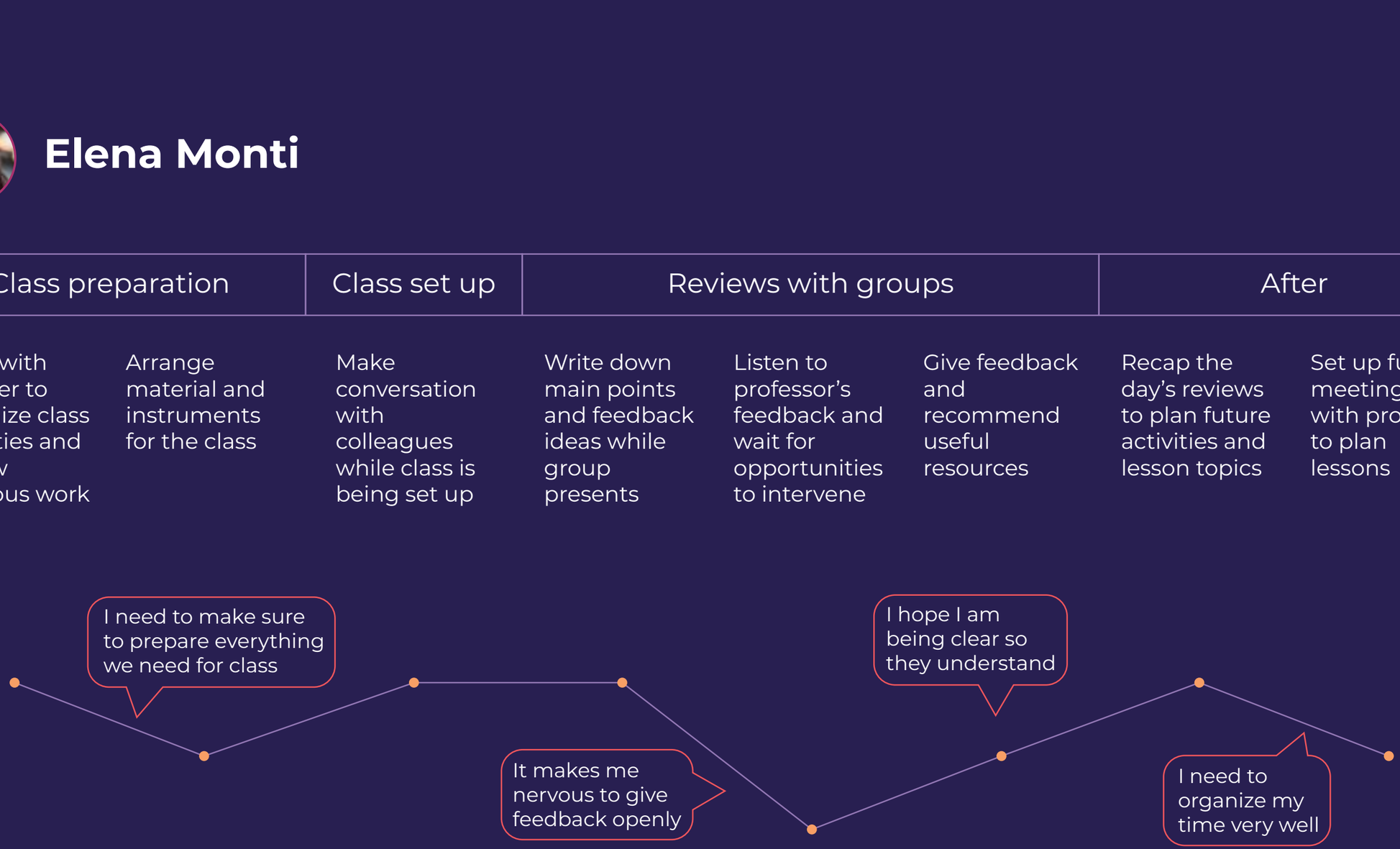
Instruments that help the conversation between reviewers and teams flow, resulting in better feedback and time management.

Tools to gather and analyze all the feedback given to understand the current situation and plan accordingly



Elena Monti

Class preparation		Class set up	Reviews with groups			After	
Meet with teacher to organize class activities and review previous work	Arrange material and instruments for the class	Make conversation with colleagues while class is being set up	Write down main points and feedback ideas while group presents	Listen to professor's feedback and wait for opportunities to intervene	Give feedback and recommend useful resources	Recap the day's reviews to plan future activities and lesson topics	Set up future meetings with professor to plan lessons



Space to view general information about the class projects and the work to date to help external reviewers get an idea of the situation.

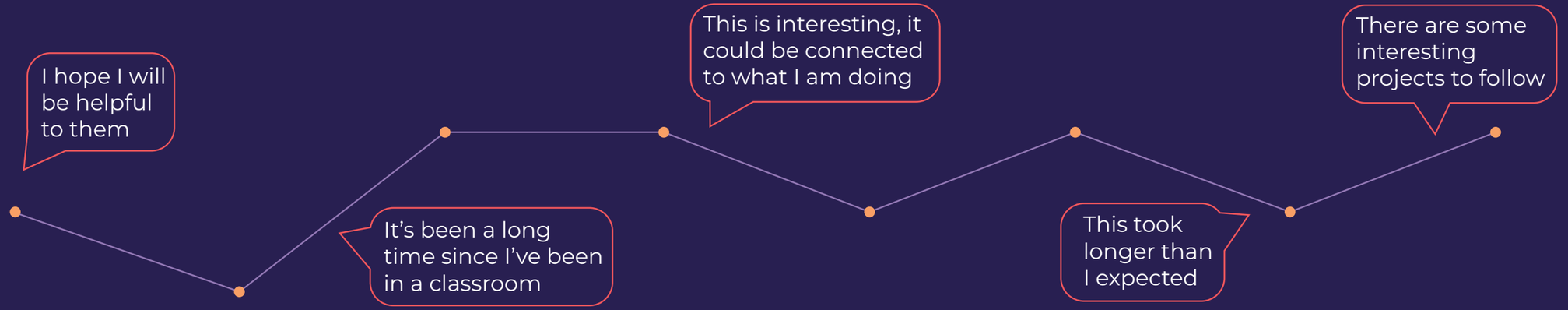
Assign roles for the review, so everyone involved has a task and information can be shared and captured more efficiently.

Tool to guide reviewers through the feedback process, so groups and reviewers set goals for each lesson that provide cues to give fitting feedback.

Tools to gather and analyze all the feedback given to understand the current situation and plan accordingly

Bruno Consoli

Debrief	Class set up		Reviews with groups			After	
Meet with teacher to comprehend class procedures and topics	Get familiar with setting and dynamic	Make conversation with colleagues while class is being set up	Write down main points and feedback ideas while group presents	Listen to professor's feedback and wait for turn to intervene	Give feedback and recommend useful resources	Give feedback about activity and projects to professor	Thank for the invitation and discuss possible collaborations



Space to view general information about the class projects and the work to date to help external reviewers get an idea of the situation.

Space setup that allows fluid communication, interaction, and easy rotation of groups while maintaining the conversation private and at a reasonable volume.

Space for outside actors to keep tracking a project they are interested in and can provide advice, offer opportunities, or observe from afar.

Distribution of groups in different review teams, so time is used more efficiently, and teams receive comments from diverse perspectives

The users' pain points and difficulties become apparent when we observe their' experiences during design reviews, which present opportunities for change and improvement. It is interesting to note that even though each user has a different experience — given their goals and interests— the possibilities to ease their pain points and heighten their enjoyable moments tend to coincide. Below is the synthesis of opportunities that may make the experience more pleasant and engaging to users.

Before arriving in the classroom for the review:

- Establish spaces to discuss, share doubts and ideas, solve questions, and share resources, within groups and between them. Which everyone can access in their own time, and where everybody can contribute. That promotes peer learning and alleviates the workload for teachers.

- Distribute a general project schedule to guide students through the course's progress and design methodology, so they have a bigger picture of what needs to get done and when and are given the flexibility to organize their time accordingly. That is frequently revised, updated, and broken down into smaller sections as time passes.

- Implement tools to set goals, tasks, and due dates to help groups manage their projects and keep team members connected and updated on what everyone is doing while working remotely.

- Create a space to view class projects and their progress to help external reviewers understand the current situation and class dynamics.

During the design review:

- Organize spaces that allow discussion, interaction, and fluid communication; flexible enough so class members can divide into groups, and teachers and assistants can naturally go around to solve doubts or give feedback.

- Introduce tools to share information and ideas during discussions, so groups can collaborate on the material presented to get their point across efficiently, receive better feedback and create more connections.

- Assign roles for the review process where everyone involved has a distinct task, efficiently sharing and capturing information. Roles can replicate interactions between stakeholders of the territory or job positions in a team; this way, students develop different reviewing and empathy abilities and give more effective feedback.

- Include gamification tools to encourage participation, keep track of individual progress, promote self-directed learning, and prompt proactive students to lead and help move along activities proposed by teachers.

- Design class activities in which members of different groups interact to discuss, share ideas, give feedback, and create connections between projects. So, when teams meet later, they have more perspectives to move forward in their projects. This way, time spent in the classroom is used more efficiently, and everyone is involved.

- Create instruments to structure class exercises, providing directives to promote discussion and guide reviewers through the feedback process but leaving space for conver-

sation, creativity, and casual interaction, resulting in better feedback and time management.

After the design review both inside and outside the classroom:

- Suggest using instruments to capture and register information during the review process to make it readily available to other team members to work and make decisions based on the feedback received.
- Use virtual spaces and tools that illustrate the work dynamics and assignation of responsibilities in a team, in a way translates the interactions of working in a physical location to the digital space and keeps a record of the organization and development of tasks.
- Open spaces in class to discuss and analyze feedback received, understand the current situation, and set up goals for future work, planning the steps necessary to get there.
- Create a space for outside actors to keep tracking a project of their interest so they can provide advice, offer opportunities, or observe from afar.

4

COURSE DESIGN

User analysis gives us a better understanding of the different types of people who interact during design reviews and their experiences with the current course structure. From this, we can visualize the possibilities for change and improvement. However, given the considerable number of ideas and tools that emerge to modify the activity, we consider it necessary to rethink the whole design review experience. In this way, the different instruments and spaces can be woven into the new structure to create a concise experience that satisfies the various users' needs.

Based on the comprehension of users, the best way to ensure that a learning experience will satisfy the learner's expectations and accomplish the acquisition of knowledge and skill required by learners, teachers, and institutions is to define the desired learning outcomes. This process will ensure that everyone involved in the design understands the expected outcome of the experience and that all the activities, content, materials, mediums, and tools align with the same vision. Then, as the project progresses, these learning outcomes must be broken down to understand the behaviors, knowledge, and skills necessary to achieve the goals set by learners and teachers. This analysis will determine the topics and activities that need to be covered during the experience for it to be successful; in other words, the content of the course.

The next step is defining the structure that will guide and support the experience, which includes the order in which the content will be presented to make it valuable and comprehensible to

the learner and how the topics will connect and flow to make the experience enjoyable and engaging. Once the general structure is established, a more detailed approach is needed to determine the channels, settings, tools, and material to deliver content. These are the elements that learners interact with, the things they see, hear and do. "Great learning experiences don't just provide the learning – they also provide a single continuous look, feel, etc. that complements the learning and doesn't distract the learner from learning" (The Interaction Design Foundation, 2020).

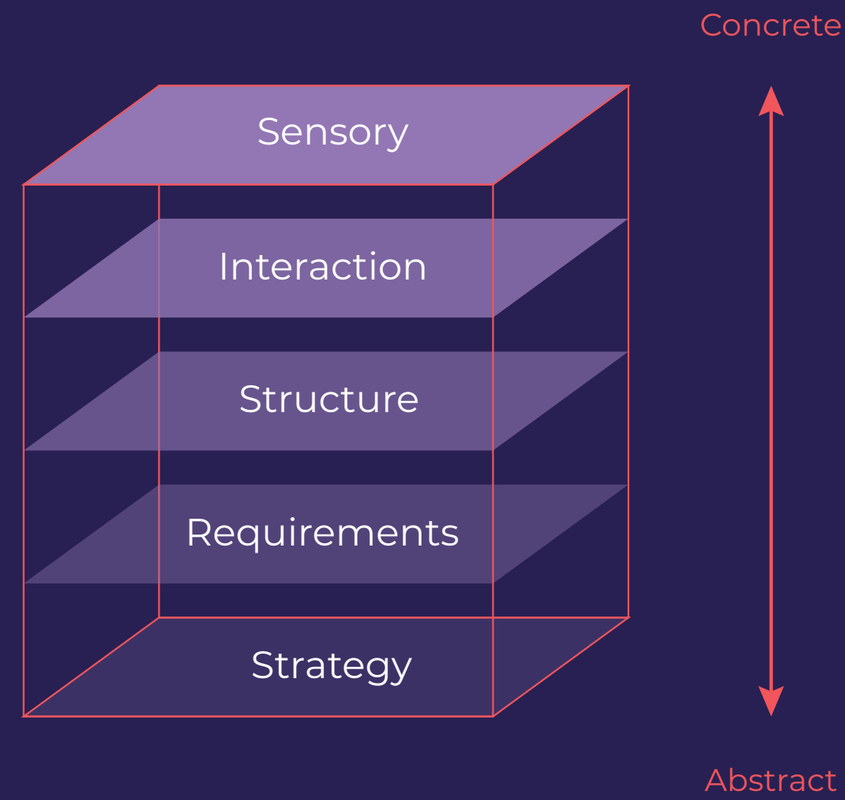


Figure 10: Elements of learning experience design by Andre Plaut

Learning Outcomes

The connectivism learning theory and the pedagogical approaches discussed in the first chapter of this thesis have shaped the theoretical foundation in which a series of desired learning outcomes have been constructed. These will define the knowledge and skills students will develop when completing the course and establish how to achieve them.

The following learning outcomes correspond to the role that education needs to have to prepare students for the problems and complexities of the future. Additionally, given the context in which the course will take place, they are influenced by the guidelines set by Politecnico di Torino in its Strategic Plan for education.

Photo by NeONBRAND for Unsplash

- Demonstrate the capacity to collaborate by participating in group discussions, contributing to team projects, and effectively communicating with others.
- Show problem-solving skills by critically analyzing a given situation and proposing creative solutions based on concrete and persuasive arguments.
- Develop leadership skills such as time management, teamwork, effective communication, and conflict resolution while working on a group project.
- Be able to autonomously lead one's own learning process, setting personal learning goals, participating in group discussions, and reaching out to classmates and teachers to solve doubts.
- Identify the project's requirements and priorities in a particular moment to set goals and guidelines for the review process to ensure a focused and productive conversation.
- Clearly and concisely present the work developed, explaining the motivations for decision-making and the results achieved.
- Assess the strengths and weaknesses of peer's work, backed by concrete arguments, and offer suggestions to improve it, supported by examples.
- Communicate effectively and empathically with peers ensuring that feedback is helpful, constructive, and critical.
- Receive feedback professionally by responding to reviewers, discussing the quality and usefulness of their comments.
- Examine, discuss and reflect on feedback and turn it into actionable items to set clear next steps.

Activities and Structure

The definition of learning activities that will structure the course is guided by the desired learning outcomes and the opportunities for intervention identified in the user analysis. The first thing that is seen repeatedly is the importance of collaboration, teamwork, leadership, and self-governing skills. Additionally, the need to exercise presentation, communication, discussion, and critical thinking appears crucial.

What stands out from the user analysis is the need for feedback and advice that students require to develop their projects and the complexity for teachers to be available for everyone when time is limited; as well as the reduced connections between classmates that leave some students dependant solely on the teacher for guidance and diminish valuable opportunities for cooperation and collaborative projects.

The main activity in the new learning experience is a redesigned review, where discussion groups are made up of individuals working on different projects. Students present the work done by their team so other members of the discussion group can provide feedback and suggest material of interest. As a result, spaces for discussion are created where teams can find opportunities for connection and partnership between projects.

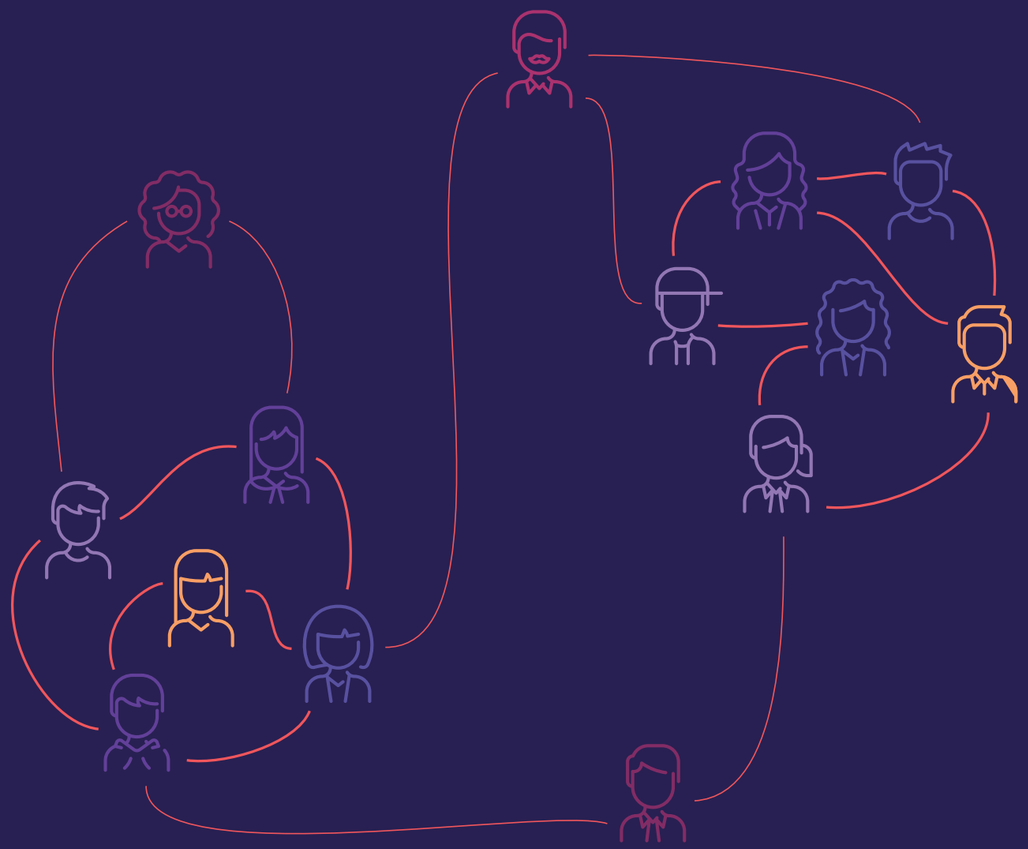


Figure 11: Redesigned review structure

All the feedback, findings, and proposals are gathered for teachers to review and keep track of teams' processes and for team members to share with their teams. Time is given after the exercise for teams to regroup, share feedback received with each other, and find opportunities for progress and improvement. Teachers guide the experience by introducing the review parameters, explaining the activity's objectives, and going through the teams to observe the discussions, solve doubts, and prompt conversation. They are supported by assistants that are available to solve questions and intervene in discussions.

This model is influenced by peer-to-peer reviews in research environments, peer learning, and peer assessment. Peer-to-peer reviews —as discussed in chapter three of this thesis— are a fundamental way of evaluating new research and guaranteeing the quality and veracity of the work published. Given their success in doing so, they are now being used in education, open-source communities, and business management as a way to keep growing and improving without the need for additional resources.

Peer learning involves students who reciprocally learn from each other. It happens naturally in some learning contexts, where students ask for guidance from a classmate, create study groups, or find a tutor in one of their classes. However, when formalized, it becomes a powerful tool in the classroom that can benefit many learners. For example, when students explain their ideas to others, they strengthen their knowledge and arguments, making them better communicators. Furthermore, learning from peers may be more comfortable and tailored to each student's needs, which is especially welcomed when schools need to teach more students than their staff can handle.

Peer learning develops the skill of learning to learn, which is essential for challenges of the future. Additionally, through this collaboration, students interact, get to understand each other both personally and through their ideas, and expand their own perspectives. Peer learning encourages cooperation and teamwork, and it creates a space where multiple ideas and experiences can be shared and valued.

On the other hand, in peer assessment, students evaluate their classmates' work based on criteria set by the teacher. The activity can take a formative approach, where students give feedback on their peers' work, who then revise the comments received to improve their work for the final evaluation made by the teacher. Alternatively, in the summative approach, students assess their peers' final product and provide an evaluation based on a grading rubric.

Peer assessment is usually implemented into courses because it grants students some ownership in the assessment process, providing an opportunity to develop self-awareness of their work and their learning process. Furthermore, it is a great strategy to receive feedback more frequently than when the teacher is the only one providing it; while developing interpersonal and critical thinking skills.

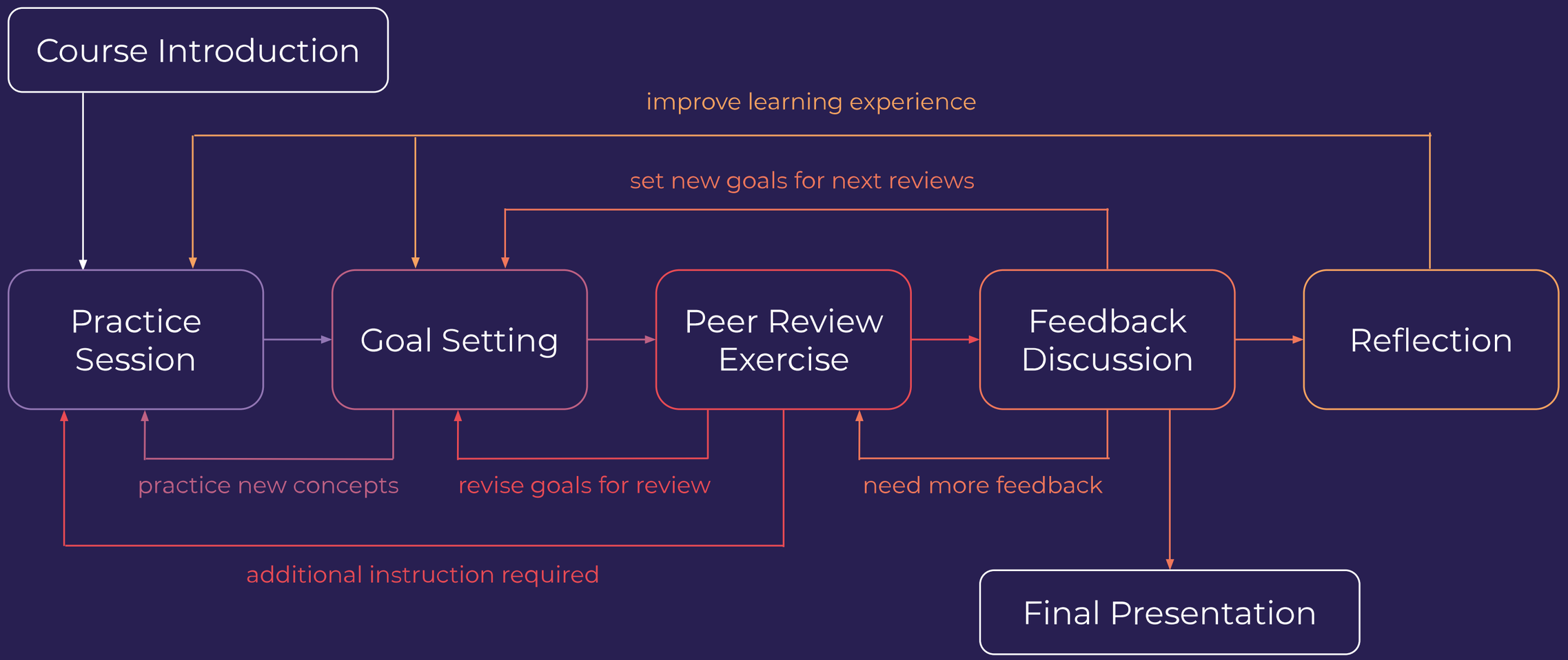


Figure 12: Course activities and structure

To structure the new review model, a series of activities are organized; before reviews, to give context and helpful information, and after, to assess and modify the experience for the future. Given the cyclical nature of the design process and the opportunities that arise in a review, the course structure is iterative, presenting opportunities to move forward with the new information received or to revise the activity's results and adjust it to obtain more satisfactory outputs.

Course Introduction:

To introduce the course topic and the learning path, teachers present the general concept of peer reviews and clarify its purposes in a frontal lesson. It is crucial to explain the importance of learning to review the work of others, as well as receiving feedback. In addition, teachers should highlight the advantages of peer reviews when developing a project both in educational and professional settings, especially in design. Finally, goals for the course are established to provide students with the assessment criteria taken into account to evaluate learning success.

Practice Sessions:

Given that most students have limited experience with peer reviews and might feel uncomfortable or insecure assessing their classmates' work, it is important to follow the first explanation of peer reviews exploring the type of comments and suggestions required of students during reviews. This activity combines theoretical lessons with practical exercises and student participation. First, teachers demonstrate how to construct feedback by reviewing a mock project presentation and pointing out where and how a reviewer can intervene. Then, to consolidate this explanation, the exercise is repeated; only this time, students provide feedback on a mock project presentation, and responses are discussed with the whole class so everyone can learn from the experience. Finally, a list of peer review criteria that students can use as a guide when giving feedback is created in a collaborative brainstorm dynamic.

Goal Setting:

When preparing a design review, it is advised to establish a set of priorities and goals to guide the review. This makes it easier for the design team to define their intentions and construct a presentation to communicate them. In addition, it is a way for reviewers to give better feedback, concentrating on what can be changed and the type of comments that are useful at the moment.

Teachers need to communicate the usefulness of setting goals and constraints for a successful design review and explain the types of intentions and priorities teams can set for a review and how best to communicate them to reviewers. To complement this explanation, they demonstrate how goal setting impacts the review process by asking for feedback on a mock project presentation but establishing different focus points to discuss each time. Teams then set general project goals and revise the course calendar to create a project timeline and deliverables to guide them through reviews.

Peer Review Exercises:

Peer reviews are the center of the learning experience; thus, they should be done repeatedly to give students as many opportunities to give and receive feedback and practice their reviewing skills. Reviews start early in the course to provide groups enough time to get familiarized with the activity and with each other because trust and a safe environment are necessary to ensure a successful peer-reviewing experience. In addition, the time between reviews should be sufficient to allow teams to discuss the feedback received and make changes to their projects.

Before each review, teachers provide teams with a worksheet

to guide them in setting the goals for the day's review (including what can and cannot be changed, the type of feedback they are looking for, the points of focus of the discussion). Teams should be specific and narrow about their goals for a particular review to avoid confusion and help them get as much valuable information as possible.

For the first reviews, each student receives a worksheet with guidelines for the activity and questions that may help them assess their peers' work and give better feedback. It is important to designate enough time for each team to present their work, receive feedback from the group and open a space for questions and discussion. Finally, assigning a monitor for each group to keep track of time will ensure that the conversation stays on topic. Students can take turns in this role, so the responsibility does not fall just on one person.

Teams start by briefly recapping previous meetings and project history to get everyone on the same page and explain the problem they are trying to solve with their work. They then present their work, explaining their rationale for the decisions made. Next, reviewers write notes on their peers' work based on the guidelines for the activity. This way, every student has the chance to form an opinion and assess their classmate's work before others start commenting. Finally, a space for discussion opens; students can ask questions, give feedback, debate ideas, work through issues, and create connections with other teams.

While groups review each other's work, teachers rotate through the classroom, ensuring that groups stay focused. They solve any doubts students may have and encourage students to

expand on their comments, making sure they are as clear and helpful as possible. If students are struggling to give or apply feedback, consider providing additional guidance and doing more practice sessions to foster a learning environment and solve any doubts that may have arisen during the experience.

Teachers evaluate the progress of each team, pairing for reviews teams that are behind in the design process with teams that have managed to figure out what to do and how to do it to encourage peer learning and a cohesive advancement of the class.

Discussions on Feedback:

Once students receive feedback, it is helpful to provide time inside the classroom for teams to get together, share, and discuss the suggestions received. Feedback should be evaluated to decide what will be used and discarded; it is valuable for students to describe the strategies they will use to make changes based on the recommendations received. Teachers can provide a feedback form for each group to write down observations on the quality and usefulness of the reviews received from their peers, which they can later share with their reviewers to help them improve their reviewing skills.

Reflection:

Reflecting on the learning process may be as important as the knowledge acquired; it creates self-awareness and gives students tools to direct their learning in the future. Teachers should open spaces during the course for students to think about the peer review process and share their experiences, including dis-

cussion topics like what has gone well, what needs adjustment, what has been challenging, and what they have learned. This exercise might also be valuable as feedback to keep improving the learning experience.

Final Presentation:

In the final phase of the course, teams present their finished projects to the whole class; they explain their process and results. Their peers can view where and how their input influenced their classmate's work, and teachers can assess the success of the learning experience on the project outputs. It is a space where potential users can explore the different projects and give feedback from their particular points of view.

Assessment

Peer reviews are designed to be a formative process focused on learning rather than assessment (Mulder et al., 2012). However, assessing needs to be considered when implementing peer learning in a course, given its traditional influence on formal courses. Assessment is usually regarded as an indicator of importance, both by students and teachers. Additionally, assessment can serve to acknowledge the additional energy and effort required to carry out peer reviews.

Nevertheless, the soft skills of peer review's learning goals are not always easy to assess. In addition, research from Boud et al. (1999) found that students do not feel comfortable when comments and assessments that they make of their peers' work are used as a grading tool because it inhibits cooperation and breaks trust and friendships. This requires alternative forms of assessment, where, instead of focusing on learning outcomes, the learning process is emphasized. A way of doing this is evaluating participation so that it is not possible to pass a course without being involved in peer reviews.

A valuable tool to ensure that learning outcomes are assessed and that the information provided by peers is reflected in the final grade is self-assessment informed by peers. By being involved in the assessment process, students better understand the learning goals and the evaluation criteria, which makes them more qualified to evaluate their own work and use the information provided by their peers to improve their learning process.

Peer assessment and self-assessment informed by peers are great strategies to involve students in the assessment process and empower them in their decision-making processes. They give students independent judgment criteria, liberating them from the teacher's point of view as the only source for evaluation. Instead, the teacher becomes a moderator, ensuring that criteria and grading scales are consistent across groups so that everyone is working on a level playing field.

Photo by Kindel Media for Pexels

For the learning experience of design peer reviews, the assessment strategies are based on the qualitative feedback provided by students for their peers' work and presentations. Reviews are done at different stages of the design process, so students can revise their work and improve upon it. However, they also provide information inputs for teams to evaluate their work and progress throughout the course, helping them in their self-assessment process.

Grading will be based partially on the presentation and discussion of the final design solution. Given that this work is done in teams, students will be evaluated on their collective efforts, promoting teamwork, communication, project management skills, and cooperation. The other part of the evaluation regards the assessment of participation in peer-reviewing activities, including their interactions with peers, provision of feedback, effective communication, and conflict resolution. It is not possible to pass the course without demonstrating involvement in peer review activities, supported by attendance, participation, and peers' feedback on the comments received.

Peer assessment will be partly substitutional, which means that students will receive marks from teachers and their peers for their final presentation. Teacher's grades will be informed by the work done for the project, and the feedback students provide in peer reviews. The role of the teacher will be to ensure consistency across groups and to check that non-negotiable criteria applicable to the course are included in the assessment.

Channels

A series of digital or physical channels need to be outlined to define and support the communication and interactions between learning actors. Pedagogy needs to be supported by both technology and spaces to create a truly immersive and engaging experience, which can only happen if learning spaces integrate technological tools to broaden and include new physical and digital spaces where learning can happen. (Sancassani et al., 2019)

Three main channels are outlined to carry out the different activities of this learning experience. The first one is a space that supports multiple and diverse learning programs and pedagogies and can be reconfigured depending on the scheduled activity. It should have enough space for all the learning actors to interact within but can integrate virtual spaces and tools so more students can participate and more flexibility is supported.

Analog spaces consist of classrooms with flexible furniture and installations like those proposed by Politecnico di Torino in their Masterplan (detailed in chapter two) or the *Future Classroom Lab* created by European Schoolnet in Brussels (Bannister, 2017). These create the space for intimacy and trust between groups and allow teachers to visualize the entire classroom to gain information about the general situation and be part of different groups. However, they require physical presence, which might not always be possible, and most importantly, they are a significant investment in resources and space given that the furniture and classroom installations have to be created thinking of the different class dynamics.

Figure 13: Future Classroom Lab by European Schoolnet

Digital tools that can provide more flexibility include video conference platforms and learning management systems. They provide similar resources to interact, communicate, and work remotely and can be as simple and familiar as a *Skype* or *Zoom* call service or as complex as *Webex* or *Blackboard* that integrate with larger systems to provide additional features.

The second channel is a collaboration platform where students and teachers can present, produce, and interact with content to understand what is explained, shared, or reviewed. Again, existing technological tools and resources should be combined to allow everyone in the conversation to visualize and connect ideas, promoting collaboration and discussion within groups, between teams, or with the whole class.

Some of these tools are analog, like posterboards and printed artboards, that allow teachers and learners to present their work and can be intervened using markers and post-it notes. A few learning management systems, such as *Big Blue Button*, offer the possibility to share files and for others to intervene by adding comments or digital notes; however, this is not their main feature, so it is not as well developed.

Digital collaborative work platforms and file storage services provide the best alternative to create spaces for collaboration and interaction. File storage services like *Google Drive* and *Dropbox* allow users to visualize and modify shared files and content. However, they are optimized for written documents in standard formats like *Word, Excel,* or *PowerPoint*, which may be limited for the outputs produced by designers. On the other hand, collaborative work platforms include *RedPen, Milanote, Bit.ai, Cage, Hightail, Concept Inbox, Mural, Miro,* and *Go Visually*. These offer the most diverse tools and features that make collaboration easier and encourage interaction with content. Additionally, they are great for remote work and allow feedback to be stored for later review or to share with others. Each one may be better suited for different types of content, so it is helpful to have many options and choose the one that adapts better to the course and the teams.

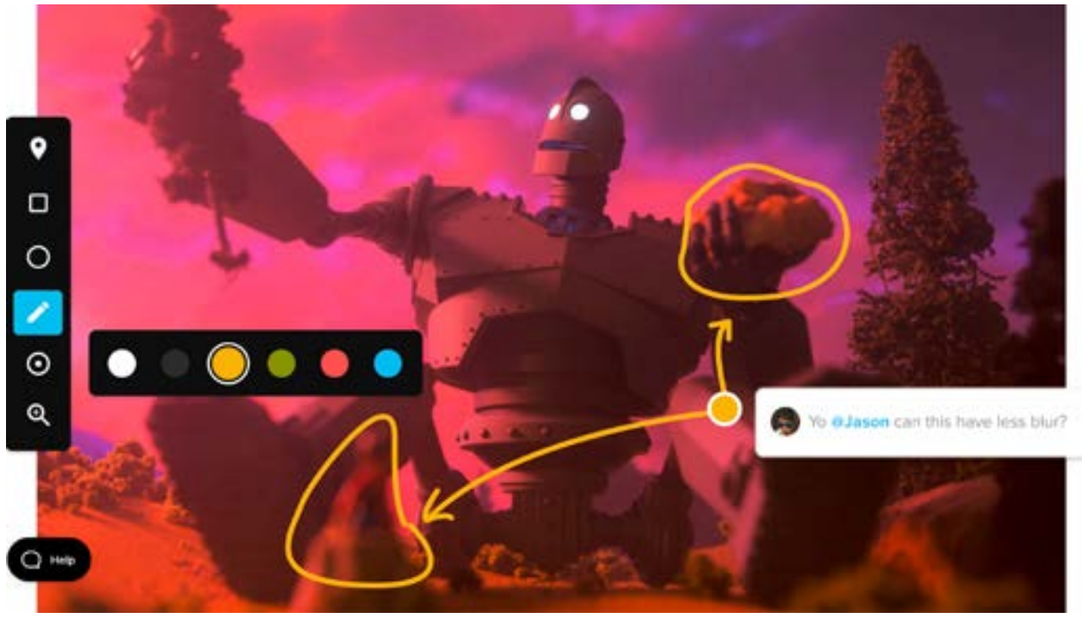


Figure 14: Media Collaboration Platform by Cage

The third channel is a space outside of the classroom that everyone can access anywhere and anytime they need to. Here learners —regardless of the team they work with— can discuss, share doubts and ideas, solve questions, and share resources,

which should promote peer learning and alleviate the workload for teachers. In addition, teachers can share explanations and presentations through this platform so each team can review them when they need to in their design process. This fluid and multifunctional channel makes the interaction between peers and teachers immediate, rapid, and fully integrated with educational activities.

Existing platforms and tools that could support this channel include forums, project management platforms, messaging, and community apps. Forums offer a structured discussion space that teachers can construct with their desired parameters and provide a secure and moderated space to share information on the course's topics. Community apps like *Discord* or *Slack* are already built and offer most of the advantages of forums while being easier to set up and use. Project management platforms —like *Proofhub, Ryver, Basecamp,* and *Wimi*— have many resources and tools that make discussion inside teams easier and efficient. However, they require teams to change how and where they work and might not encourage conversations between teams. Lastly, messaging apps such as *Whatsapp* and *Telegram* could become great complementary technologies to support interaction. Even though they do not have as many functions and configurations, learners' familiarity with the tools can be crucial.

5

CASE STUDY

Course Analysis

Now that the course structure is established, the next step in creating a successful learning experience is defining how learners will be introduced to new skills and knowledge in a way that will make the experience coherent. To do this in a way that can be analyzed and tested, an existing design course will be examined to determine what can be improved and how the new review structure can be implemented.

For this thesis, the course analyzed as a case study to implement the new review structure is Design by Components from the Master of Science in Systemic Design. It is a course of the second year, held entirely in English and accompanied by three parallel classes that complement the topic of the main project. According to the study plan for 2021/22, the aim of the course is “to understand the problems associated with the development of new complex products, designed starting from the skills of professionals in both traditional and modern digital production systems, thus defining new manufacturing paradigms on a small, local scale.”

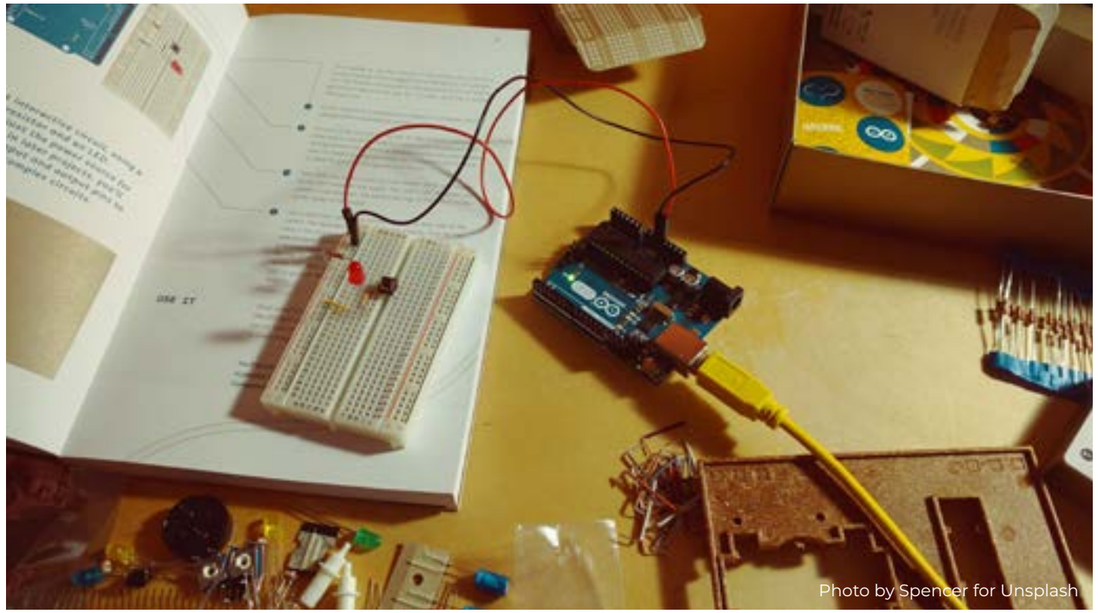


Photo by Spencer for Unsplash

The course focuses on designing an industrial product by analyzing its components, their technical characteristics, and the material and energetical relationships that connect them and make them work as one. To do this, both theoretical lessons on design methodology and analysis of industrial products are outlined. The work is carried out in teams who design, conceptualize and prototype a new product, considering the potential user and its socio-cultural environment. Innovative methods and technologies are encouraged, including Open Design, the Internet of Things, Makers and FabLabs, and digital manufacturing processes. “In this regard, learning objectives consist of teaching new designers the culture of modular design of the product, through existing territorial competences and the inclusion of new professional figures in the digital production of objects.” (Portale della Didattica - Componenti del Prodotto, 2021)

The SWOT analysis is a tool created in the 1960s by Albert Humphrey of the Stanford Research Institute to evaluate an organization's competitive position before making strategic decisions. Therefore, it will be used to assess the course's current situation, taking into account internal and external factors, as well as current and future potential.

This analysis is a helpful tool to identify different strategies to integrate the new review structure with the Design by Components contents and topics. As a result, a cohesive course can be constructed by building strengths, minimizing weaknesses, seizing opportunities, and counteracting threats.

Figure 15: SWOT analysis for Design by Components course

Strenghts

- Promotion of teamwork by developing projects in groups
- Focus on project based learning given that concepts are learnt while being applied in the class project
- Work with local actors that encourages students to empathize and interact with their context while allowing them to receive feedback from real users
- Focus on systems, understanding how things connect and work together
- Practical applications of knowledge through the development of prototypes to test ideas
- In-depth analysis of product and context characteristics in courses parallel to the design course
- Freedom for each group to choose the area of work they prefer to develop their project
- Availability of resources and tools to develop prototypes, in a way that connects students with their target users, getting into the maker mindset

Weaknesses

- Lack of coordination beetween courses to schedule reviews and provide feedback at useful stages of project development
- Lack of connection between different groups and of spaces for them to interact, communicate and share their experiences
- Review sessions that depend on one teacher to provide feedback, which tend to take longer than expected and leave students with a lot of waiting time
- Dependance on one teacher for guidance, evaluation, and solving questions to make decisions, which results in teams getting stuck and lacking alternatives to move forward
- Lack of theoretical content to guide students through the design by components process
- Lack of connection between the theory of parallel courses with the practicality of the design course

Opportunities

- University's strategic plan that encourages collegi to create innovative courses with new teaching methodologies
- Students from different cultures, countries and educational backgrounds that can enrich discussions with their points of view
- Teachers from different areas and educational backgrounds that, if properly connected, could give rich and diverse feedback
- Teaching Lab as a space to discuss with other teachers and learn from their experiences
- Experience with remote learning tools and methodologies that can mix up class dynamics and contribute the best of both worlds

Threats

- Time needed to create and test new methodologies
- Time required of students to learn concepts, develop a project and acquire soft skills
- Unwillingness form teachers and/or students to change class dynamics and put themselves in an uncomfortable possition to learn
- Lack of physical spaces that allow for new class configurations and activities
- Resistance form students to collaborate and work together with people from different cultures, that speak different languages or that work in different ways
- Difficulty in assessing and evaluating new forms of education given the formal context of the university and the expectations of teachers and learners

Strategies:

- Take advantage of teachers' diverse knowledge and background from parallel courses to enrich students' feedback during project development and reinforce theoretical concepts by applying them to the group project.

- Use virtual and remote resources that help students review design theory concepts and are available for them to access at their own pace, depending on their project's process.

- Create communication channels and spaces that allow groups to interact with each other and help solve doubts or share resources that may be useful for other teams when they are stuck, benefiting from the diversity in experiences and knowledge.

- Incorporate activities that promote the acquisition and strengthening of soft skills like collaboration, problem-solving, leadership, and decision-making while contributing to project development.

- Develop learning activities that emphasize working together and connecting; topics important in design by components and systems theories.

- Use virtual or on-the-field spaces that may be more flexible to try out different class dynamics that involve configurations not possible in classical classrooms.

- Implement assessment that includes the context and users of the projects, making user's comments valuable and relevant to the evaluation process.

- Promote efficient use of time during class reviews with activities that encourage collaboration and discussion on class topics and group projects.

- Use the Teaching Lab to check if others have tried new methodologies, get their advice, and build on their experiences.

Course Structure

The Design Thinking Process is a design methodology to solve complex problems by defining a series of stages that make them more manageable. It will be used to implement the new review structure while guaranteeing that the Design by Components course content is learned, resulting in the design, conceptualization, and prototype of a product.

The process consists of five stages. The first one is empathizing, where information is collected to understand the problem. It involves consulting databases, talking with experts, engaging with potential users and their environment, and observing using various research tools. The second stage is defining; the research is synthesized to find insights and define the problems that need to be solved. Maps, storyboards, and other analysis tools are helpful tools to better understand and find patterns in the information collected. Next, during the ideation phase, designers generate ideas that may solve the problems encountered. Collaborative brainstorming sessions are helpful to notice different ways of looking at the problem to find more creative solutions.

Once a number of possible solutions are identified, it is time to develop them and put them to the test. The fourth stage is design/prototype, where models of the ideas are created to understand how they look and work. They can be as simple as sketches or wireframes or as complex as functioning prototypes; this depends on the resources available and what the design team needs to validate. Finally, designs are tested both within the team and with potential users to gather as much feedback as possible. Given that new information will arise during the testing phase, the design process acquires an iterative nature to continuously improve the design solutions.

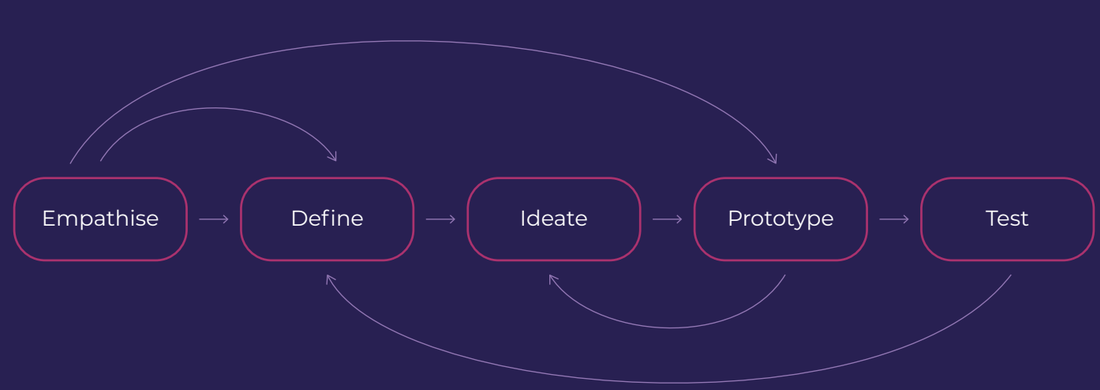


Figure 16: Design Thinking Process by Interaction Design Foundation

The design process needs to be adapted to the academic calendar to ensure that students have enough time to go through every stage of the design process and achieve the expected out-

comes. Ideally, at the end of each phase, a concrete output is developed; however, given that design is iterative and not linear, the course calendar serves more as a point of reference for teams to organize their work and for teachers to keep track of the teams' progress to guide those that need it most.

Introduction to the course and explanation of the topics and group project	Weeks 1 - 6
Research and discovery	Weeks 3 - 6
Analysis and concept	Weeks 7 - 9
Ideation	Weeks 10 - 12
Christmas break	
Prototype development	Weeks 13 - 14
Final presentation preparation	Weeks 15 - 17
Final presentation	Weeks 18 - 20

Figure 17: Design process scheduled in the academic calendar

In each of these phases, the different activities of the new peer review model are incorporated. These activities will address different topics and produce different results while conserving the general structure outlined in chapter four. Additionally, given the iterative nature of the process and the diverse circumstances presented at each stage, peer reviews can be done multiple times, giving students enough opportunities to practice their reviewing skills and receive varied feedback. The following calendar schedules the activities for each phase in the course's calendar for 2021/22.

October 2021

1 Course Introduction
2 Design by Components
3 Fablab Presentation
4 Intro to Peer Reviews
5 Peer Reviews

	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November 2021

6 Goal Setting for Reviews
7 Product Analysis
8 Peer Reviews
9 Design Concept Presentation
10 Generation of Ideas

	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	

December 2021

11 Peer Reviews
12 Design Solution Presentation
13 Prototype Development

			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

January 2022

14 Peer Reviews
15 Presentation Preparation
15 Presentation Preparation

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

February 2022

15 Presentation Preparation
16 Final Project Presentation
16 Final Project Presentation
16 Final Project Presentation

	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

Figure 18: Academic calendar 2021/22 for Design by Components course with peer review activities

The first week is dedicated to introducing the course, its topics, calendar, and goals. It is the opportunity to explain the class project and for students to get familiarized with their classmates to create the teams. In addition, the new channels for communication available for students and teachers to connect should be presented and tested to encourage students to use them.

In week two, teachers delve into the topic of design by components. Through a theoretical lesson with examples and exercises, they present the concepts of the methodology, emphasizing its advantages and importance for the design process.

During week three, the class moves to the Fablab, where teachers, with the help of Fablab users, explain the Open Design topic, emphasizing its role in maker spaces. Later, a tour of the space gives students an idea of the environment they will work in, and they are encouraged to explore the space, talk with makers and start their research while teachers are available to solve doubts. This activity works as a theoretical introduction to the course and the first step in the empathizing phase. The Fablab will remain —for the duration of the course— a space for students to work in and collaborate, using the tools and makers' experiences to shape their projects.

Week four is when the peer review learning experience integrates with the existing course structure. In this week's class, the introduction to peer reviews and practical exercises to learn how to review peers' work described in chapter four take place. It combines a theoretical lesson explaining the characteristics and importance of peer reviews with applied learning, where feedback construction is explained through examples given by the teacher and exercises in which the whole class participates. Given that students are working in parallel on research and discovery, the teacher will be available at the end of the class to solve doubts and review the work done by teams.

In week five, the first peer review activity is carried out. Teams present the work done in the research phase, and their peers assess their work based on the provided guidelines. Given that it is probably the first experience of students with this type of review, teachers and assistants need to be particularly present and available to solve doubts, encourage discussion and guide students through the process. After group reviews, teams get together to analyze the comments received, write down observations on their peers' reviews, and decide the next steps they will take. In addition, a space for reflection where students share their experience with the activity —either by talking or writing it down— would be extremely valuable to the course's progress.

After students have their first experience with peer reviews, a relevant tool to add to their skillset is goal setting for reviews. In week six, this concept is explained and practiced. First, teachers describe the importance of setting goals for effective reviews, the methodology, and how different goals change feedback. Then teams set goals for the project and the following review to practice what they have learned and improve their presenting skills for future reviews.

During week seven, teams enter the definition phase. To guide them in this process —using the tools provided by the Design by Components methodology— teachers explain how to analyze a product, understanding its technical characteristics, identifying its components, the relationships that bind them, and the material and energy flows that make them work together. After this lesson, teams work inside the classroom on their projects while teachers remain available for groups to ask questions or solve doubts.

In week eight, students participate in their second peer review. This time they present the work they have done analyzing the information collected during previous weeks. At the beginning of the session, they present their goals for the review to help their peers give more accurate feedback. After group reviews, teams get together to analyze the comments received, write down observations on their peers' reviews, and decide the next steps they will take.

For week nine, a new activity is introduced, where teams briefly present the results of their work —up to the point they have reached— for an in-class presentation. Ideally, all teams have a clear design concept from their analysis; but given that there may be setbacks or disparities, the presentations are a space for teams to catch up with the work of others. All the course teachers are invited to give feedback and stay updated on the teams' projects' progress. In the weeks following the presentation, teams can ask for help via virtual forums and group chats where others can share resources, give advice, or help teams that are stuck or lost in their design process.

In week ten, teams move to the ideation phase; teachers give a general explanation of the work teams should be working on during the next few weeks and suggest some tools to guide them. While teams work in the classroom, teachers are available to solve doubts and explain specific topics per student's requests. Additionally, reviews with teachers from parallel courses can be set up to guide students with doubts in particular subjects. Lastly, teachers should evaluate the progress of each team so that later, when pairing them for reviews, teams that have managed to figure out what to do and how to do it can guide teams that are behind in the design process.

Week eleven brings another round of peer review activities. The dynamic is the same as last time; however, this time, students have more experience, so they should be able to conduct the reviews with less supervision. Peer review groups assess each other's sketches, mood boards, models, or other material to display their design solutions. Then, peers give feedback on the work presented and help teams achieve their goals for the review. After group reviews, teams get together to analyze the comments received, write down observations on their peers' reviews, and decide the next steps they will take.

Just like at the end of the definition phase, to close the ideation stage, teams briefly present the results of their work to the whole class, including teachers and external reviewers. Ideally, all teams are concluding the ideation phase; however, some may still need to work on it to arrive at a final solution. It is a space for students and teachers to assess the general situation and find support from teams ahead in the process to help those with difficulties.

Photo by Mart Production for Pexels

Before leaving for Christmas break, teams have a class during week thirteen to work on creating their prototypes. They can either work inside the classroom or in the Fablab, where they find different tools to build their designs. Teachers are available to solve doubts and explain specific topics per student's requests. Additionally, reviews with teachers from parallel courses can be set up to guide students with doubts in particular subjects.

After the Christmas break, on week fourteen, groups get together to give feedback on each other's prototypes in a final peer review activity. It is a space where trust has been created, and peers can give honest and valuable input that may serve teams in the testing phase. After group reviews, teams get together to analyze the comments received and decide which modifications they should make before the final presentation.

Between the last class and the date of the final presentation, there is usually some time that teams can use to work outside the classroom finishing their prototypes and constructing the presentation to present their work and process. If needed, reviews with teachers can be organized to solve specific doubts; however, the digital community networks are always open for teams to consult with their peers and get feedback on their work through these channels.

On the day of the final presentation, a showcase of the class projects and prototypes is created. Teams present the final project to the whole class; they explain their process and results, their peers can view where and how their input influenced their classmate's work, and teachers can assess the success of the learning experience on the project outputs. It is a space where potential users can explore the different projects and give feedback from their particular points of view.

During the final presentation, peers, teachers, and guests give qualitative feedback on the work presented by teams. These comments provide the input necessary for students to assess their peers and their own work, resulting in peer evaluations and self-evaluations. These are complemented with teacher evaluations based on the final presentation and the participation of students during peer review activities (shown in peer review worksheets and feedback given by peers to comments received).

A deck of cards was created to visualize the entire learning experience, with its different phases and activities explained. They serve as a tool to synthesize the course structure and make it easier to implement. To view them in greater detail see Annex 1.


Classroom
Frontal Lesson

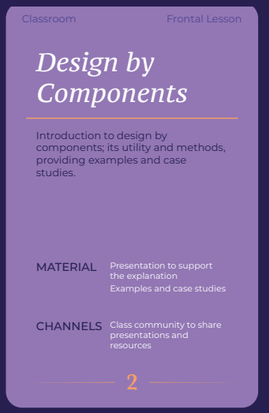
Course Introduction

Presentation of the course's topics, calendar, goals and class project. Explanation of the different channels available for students and teachers to connect.

MATERIAL
Presentation on the course structure

CHANNELS
Class community to share presentations and resources

1


Classroom
Frontal Lesson

Design by Components

Introduction to design by components; its utility and methods, providing examples and case studies.

MATERIAL
Presentation to support the explanation
Examples and case studies

CHANNELS
Class community to share presentations and resources

2


Fablab
Field Work

Fablab Presentation

Guided visit of the Fablab and introduction to open design, making emphasis on its role in maker spaces. Students are encouraged to explore the Fablab space, talk with makers and start their research while teachers are available to solve doubts.

MATERIAL
Presentation on open design
Fablab's floor plan to describe the space

CHANNELS
Class community to share presentations and resources

3


Classroom
Frontal Lesson

Intro to Peer Reviews

Introduction of peer reviews and their importance in the learning process as well as in design projects. Demonstration of feedback construction with examples given by the teacher an exercises in which the whole class participates and a set of guidelines is created for future reviews.

MATERIAL
Presentation with examples
Mock projects to exercise feedback construction

CHANNELS
Collaboration platform to interact with projects and participate in the creation of review guidelines

4


Classroom
Group Work

Peer Reviews

Peer review groups get together to assess each others work and apply their reviewing knowledge. After group reviews teams get together to analyze the comments received, write down observations on their peers' reviews and make decisions about the next steps they will take.

MATERIAL
Project presentation
Worksheet with peer review guidelines
Worksheet to guide teams in strategy construction from feedback received

CHANNELS
Collaboration platform to visualize presentations, and interact with them through comments and annotations

5


Classroom
Frontal Lesson

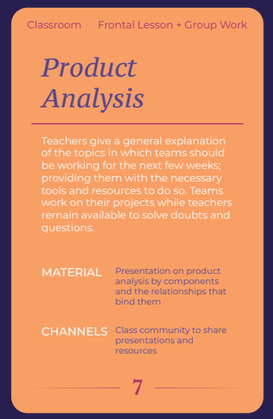
Goal Setting for Reviews

Explanation of the importance of goal setting for effective design reviews and the methodology to do so, accompanied by examples that show the way goals modify feedback received. Team exercise setting goals for the project and the next review.

MATERIAL
Presentation with examples and exercises
Worksheet to guide teams in the goal setting process

CHANNELS
Collaboration platform to solve exercises collectively, interacting with the material

6


Classroom
Frontal Lesson + Group Work

Product Analysis

Teachers give a general explanation of the topics in which teams should be working for the next few weeks; providing them with the necessary tools and resources to do so. Teams work on their projects while teachers remain available to solve doubts and questions.

MATERIAL
Presentation on product analysis by components and the relationships that bind them

CHANNELS
Class community to share presentations and resources

7


Classroom
Group Work

Peer Reviews

Peer review groups get together to assess each others work. Peers give feedback on the work presented and help teams achieve their goals for the review. Later, teams get together to analyze the comments received, write down observations on their peers' reviews and make decisions about the next steps they will take.

MATERIAL
Project presentation
Goals and priorities for the review
Worksheets to guide teams in reviews and construction of strategies

CHANNELS
Collaboration platform to visualize presentations, and interact with them through comments and annotations

8


Classroom
Group Presentations

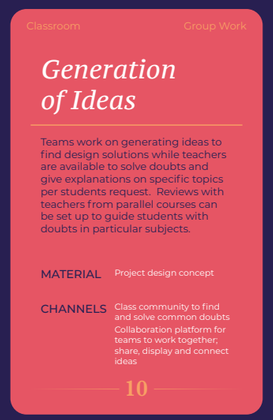
Design Concept Presentation

Teams briefly present the results of their work, up to the date. Ideally all teams have a clear design concept that has emerged from their analysis, however some may still need to work on it. It is a space for students and teachers to assess the general situation and find support of more advanced teams.

MATERIAL
Project presentation

CHANNELS
Class community for teams to communicate and find help from classmates

9


Classroom
Group Work

Generation of Ideas

Teams work on generating ideas to find design solutions while teachers are available to solve doubts and give explanations on specific topics per students request. Reviews with teachers from parallel courses can be set up to guide students with doubts in particular subjects.

MATERIAL
Project design concept

CHANNELS
Class community to find and solve common doubts
Collaboration platform for teams to work together, share, display and connect ideas

10


Classroom
Group Work

Peer Reviews

Peer review groups get together to assess each other's sketches, moodboards, models and other material to display their design solutions. Peers give feedback on the work presented and help teams achieve their goals for the review. Afterwards teams set strategies based on the comments received.

MATERIAL
Project presentation, sketches and models
Goals for the review
Worksheets to guide teams in reviews and construction of strategies

CHANNELS
Collaboration platform to visualize presentations, and interact with them through comments and annotations

11


Classroom
Group Presentations

Design Solution Presentation

Teams briefly present the results of their work, up to the date. Ideally all teams are concluding the ideation phase and have a final design solution, however some may still need to work on it. It is a space for students and teachers to assess the general situation and find support of more advanced teams.

MATERIAL
Project presentation

CHANNELS
Class community for teams to communicate and find help from classmates

12


Classroom / Fablab
Group Work

Prototype Development

Teams work on developing and constructing a prototype while teachers are available to solve doubts and give explanations on specific topics per students request. Reviews with teachers from parallel courses can be set up to guide students on particular subjects.

MATERIAL
Final design solution
Materials and tools for prototype construction

CHANNELS
Class community to find and solve common doubts

13


Classroom
Group Work

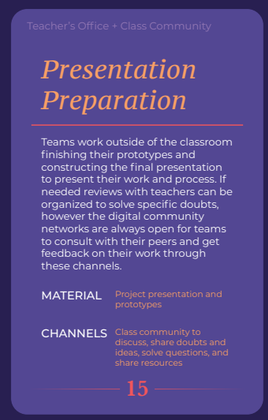
Peer Reviews

Peer review groups get together to assess each other's prototypes. Peers give feedback on the work presented and help teams achieve their goals for the review. Afterwards teams get together to analyze the comments received, write down observations on their peers' reviews and make decisions about the next steps they will take.

MATERIAL
Project presentation, models and prototypes
Goals for the review
Worksheets to guide teams in reviews and construction of strategies

CHANNELS
Collaboration platform to visualize presentations, and interact with them

14


Teacher's Office + Class Community

Presentation Preparation

Teams work outside of the classroom finishing their prototypes and constructing the final presentation to present their work and process. If needed reviews with teachers can be organized to solve specific doubts, however the digital community networks are always open for teams to consult with their peers and get feedback on their work through these channels.

MATERIAL
Project presentation and prototypes

CHANNELS
Class community to discuss, share doubts and ideas, solve questions, and share resources

15


Classroom
Group Presentations

Final Project Presentation

Teams present the final project to the whole class; explaining their process and results. Peers can view their influence their classmate's work and teachers can assess the success of the learning experience on the project outputs.

Peers, teachers and guests give qualitative feedback on the work presented by teams. Assessment is constructed based on self-evaluations, peer-evaluations and teacher-evaluations.

MATERIAL
Project presentation
Team's worksheets to show their process in the course

16

CONCLUSIONS

Education has taken many shapes and forms throughout human history, allowing us to adapt to different contexts and times. Right now, we are facing unprecedented challenges and transformations to our society, culture, and natural environment. Fortunately, we have collected information, research, experiences, and theories that can give us hints to shape education to help learners interact with the changing world in a beneficial way. More than ever, it is essential to take all the information we have and think of new ways to reconfigure and connect it to get the best results.

The Politecnico di Torino, being an influential prominent in Torino and Italy, can use its power and resources to influence a new generation of thinkers that will impact the world. The different projects outlined by the strategic plan and TLlab teachers' disposition to experiment and share their experiences are great steps in ensuring opportunities for change and improvement. In addition, the experience and knowledge acquired during the Master of Systemic Design ensured that the analysis carried out in this thesis included diverse elements and points of information that, when connected and explored, created a rich and complex experience.

The learning experience outlined and developed in this thesis creates spaces and opportunities to innovate education thinking of future challenges. An engaging and enjoyable experience was created by taking advantage of the opportunities that education for design offers, ensuring that learners develop the abilities and knowledge needed to thrive and build a better future.

The opportunity to think about the Design by Components course as a case study to apply the learning experience is invaluable and provides a space where the results of this thesis can be observed and tested. Given the spaces created in this course to think about open design, maker culture, and interactions between components, adding a practical side where these principles can be experienced and applied is very fitting. Moreover, it creates an opportunity for the new learning experience to flourish and be complemented by theoretical material.

The next step in developing this thesis would be to implement the new course structure in the current design course, guided by the outlined tools and strategies. This should allow us to understand how students experience the proposed learning activities, determine how the experience translates to the context, and acquire valuable feedback from teachers and learners. This testing phase should collect enough information to evaluate the design's success and determine what needs to be redesigned or explored differently.

References

0. Introduction

Innovation Design Lab. (2018). *The Methodology*. http://www.innovationdesignlab.it/en/the-methodology/

Tamborrini, P., & Stabellini, B. (2018). Metodologie e strumenti per l'innovazione sostenibile. *Material Design Journal, 5*. http://materialdesign.it/media/formato2/allegati_6415.pdf

1. Education

2U. (2020, August). *Teaching Methods*. Teach.Com. https://teach.com/what/teachers-know/teaching-methods/

5 Pedagogical Approaches to Reach Disengaged Students. (2020, February 16). ECU Online. https://studyonline.ecu.edu.au/blog/five-pedagogical-approaches-to-reach-disengaged-students

Academic discipline. (2021, May 24). In *Wikipedia*. https://en.wikipedia.org/wiki/Academic_discipline

Acaroglu, L. (2018, October 22). *System Failures: The Education System and the Proliferation of Reductive Thinking*. Medium. https://medium.com/disruptive-design/system-failures-the-education-system-and-the-proliferation-of-reductive-thinking-dccf7dbb9b96

Alkahtani, M., Ahmad, A., Darmoul, S., Samman, S., Al-zabidi, A., & Ba Matraf, K. (2016). Multitasking Trends and Impact on Education: A Literature Review. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering, 10*(3). https://www.researchgate.net/publication/303723387_Multitasking_Trends_and_Impact_on_Education_A_Literature_Review

All Answers Ltd. (2021, June 1). *Theories, Principles and Models in Education and Learning*. UKDiss. https://ukdiss.com/examples/education-and-learning-theories.php

Anderson, L., Krathwohl, D., Airasian, P., Cruikshank, K., Mayer, R., Pintrich, P., Raths, J., & Wittrock, M. (2000). *Taxonomy for Learning, Teaching, and Assessing, A: A Revision of Bloom's Taxonomy of Educational Objectives, Abridged Edition* (1st ed.). Pearson.

Baker, J. (2013, May 28). Industrial Age Education Is a Disservice to Students. *HuffPost*. https://www.huffpost.com/entry/industrial-age-education-_b_2974297

Barrouillet, P. (2015). Theories of cognitive development: From Piaget to today. *Developmental Review, 38*. https://doi.org/10.1016/j.dr.2015.07.004

Becher, T. (1994). The significance of disciplinary differences. *Studies in Higher Education, 19*(2). https://doi.org/10.1080/03075079412331382007

Biglan, A. (1973a). Relationships between subject matter characteristics and the structure and output of university departments. *Journal of Applied Psychology, 57*(3), 204–213. https://doi.org/10.1037/h0034699

Biglan, A. (1973b). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology, 57*(3). https://doi.org/10.1037/h0034701

Borrego, M., & Creamer, E. G. (2007). GENDER AND DISCIPLINARY DIFFERENCES IN EXPERIENCES WITH INTERDISCIPLINARY COLLABORATION. *Journal of Women and Minorities in Science and Engineering, 13*(4), 353–376. https://doi.org/10.1615/jwomenminorscieneng.v13.i4.30

Boyce, P. (2019, August 18). *Schools Are Outdated. Its Time For Reform*. Foundation for Economic Education. https://fee.org/articles/schools-are-outdated-its-time-for-reform/

Brown, J. (2019, April 19). *What Is Pedagogy? - Educate*. Medium. https://medium.com/educate-pub/what-is-pedagogy-5b2381222418

Centro Studi Pedagogia e Didattica. (2020, October 5). *La nostra idea di pedagogia, dentro e fuori la scuola*. Pedagogia e didattica. http://www.pedagogiaedidattica.it/wordpress/

Cole, K. (2019, June 11). *Pedagogy in Education: More Than a Buzzword*. Schoology. https://www.schoology.com/blog/pedagogy-education-more-buzzword

Connectivism. (2019, May 17). EduTech Wiki. http://edutechwiki.unige.ch/en/Connectivism

Constructivist teaching methods. (2021, June 29). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Constructivist_teaching_methods&oldid=436907250

Cooper, P. (1993). Paradigm Shifts in Designed Instruction: From Behaviorism to Cognitivism to Constructivism. *Educational Technology, 33*(5), 12-19. Retrieved August 3, 2021, from http://www.jstor.org/stable/44428049

Coughlan, T., & Perryman, L. A. (2011). Something for everyone? The different approaches of academic disciplines to Open Educational Resources and the effect on widening participation. *Journal of Open, Flexible and Distance Learning, 15*(2).

Deeksha, S. (2016, March 4). *Education for Children: 3 Major Components*. Psychology Discussion. https://www.psychologydiscussion.net/child-development/education-for-children-3-major-components/1155

Didactics. (2016, June 8). International Bureau of Education. http://www.ibe.unesco.org/en/glossary-curriculum-terminology/d/didactics

Didattica. (2021, July 30). In *Wikipedia*. https://it.wikipedia.org/wiki/Didattica

Doberneck, D.M., & Schweitzer, J.H. (2017). Disciplinary variations in publicly engaged scholarship: An analysis using the Biglan classification of academic disciplines. *Journal of Higher Education Outreach and Engagement, 21*, 78-103.

Ecole Globale. (2020, February 22). *Types of Education: Formal, Informal and Non-Formal*. Medium. https://ecoleglobale101.medium.com/types-of-education-formal-informal-and-non-formal-aee0495004a9

Education. (2013). In *Cambridge Advanced Learner's Dictionary* (4th ed.). Cambridge University Press. https://dictionary.cambridge.org/dictionary/english/education

Education. (2021, August 3). In *Wikipedia*. https://en.wikipedia.org/wiki/Education

eSchool News. (2009, September 4). *Four key components of Education 3.0*. https://www.eschoolnews.com/2009/09/04/four-key-components-of-education-3-0/

Experiential learning. (2021, June 16). In *Wikipedia*. https://en.wikipedia.org/wiki/Experiential_learning

Feibleman, J. K. (1961). Pure Science, Applied Science, Technology, Engineering: An Attempt at Definitions. *Technology and Culture, 2*(4). https://doi.org/10.2307/3100886

Fiore, A. M. (2018, December 22). *Connectivism: A Learning Theory for the Digital Age*. FocusEduSolutions. https://focusedusolutions.com/2018/12/22/connectivism/

Fulbrook, P. (2021, May 20). *15 Learning Theories in Education*. TeacherOfSci. https://teacherofsci.com/learning-theories-in-education/

Gambini, P. (2016). *Introduzione alla psicologia - I processi cognitivi* (2nd ed., Vol. 2). Franco Angeli.

Graham, H. F., Chambliss, . J.J. , Lauwerys, . Joseph Albert , Scanlon, . David G. , Gelpi, . Ettore , Marrou, . Henri-Irénée , Bowen, . James , Moumouni, . Abdou , Vázquez, . Josefina Zoraida , Swink, . Roland Lee , Huq, . Muhammad Shamsul , Arnove, . Robert F. , Riché, . Pierre , Chen, . Theodore Hsi-en , Nakosteen, . Mehdi K. , Meyer, . Adolphe Erich , Naka, . Arata , Szyliowicz, . Joseph S. , Anweiler, . Oskar , Thomas, . R. Murray , Shimahara, . Nobuo , Ipfling, . Heinz-Jürgen , Lawson, . Robert Frederic , Mukerji, . S.N. and Browning, . Robert (2021, May 1). Education. *Encyclopedia Britannica*. https://www.britannica.com/topic/education

Greenwood, B. (2020, February 5). *What is Pedagogy? An Introduction to Learning Theories*. Satchel. https://blog.teamsatchel.com/what-is-pedagogy-a-guide-to-learning-theories

Gual Soler, M., & Dadlani, K. (2020, August 13). *Education needs a reset to be fit for the 21st century.* World Economic Forum. https://www.weforum.org/agenda/2020/08/science-education-reset-stem-technology/

Guido, M. (2017, January 19). *What Is Inquiry-Based Learning: 7 Benefits & Strategies You Need to Know*. Prodigy Education. https://www.prodigygame.com/main-en/blog/inquiry-based-learning-definition-benefits-strategies/

Henriques, G., PhD. (2013, December 4). *What Is Knowledge? A Brief Primer*. Psychology Today. https://www.psychologytoday.com/us/blog/theory-knowledge/201312/what-is-knowledge-brief-primer

Honeyman, Catherine A. & Dang, Que Anh & Thomas, Matthew & Persson, Anna & Waugh, Matthew. (2016). 25 Ways to Improve Learning: A collection of research briefs on quality education from the IIEP Learning Portal.

Impedovo, M. A., & Iaquinta, R. (2013). From Broadcasting to Transforming. *Handbook of Research on Didactic Strategies and Technologies for Education,* 298–306. https://doi.org/10.4018/978-1-4666-2122-0.ch025

Jones, W.A. (2012). Variation among Academic Disciplines: An Update on Analytical Frameworks and Research.

Lathan, J., PhD. (2021, July 23). *The Complete List of Teaching Methods*. University of San Diego. https://onlinedegrees.sandiego.edu/complete-list-teaching-methods/

Le 7 Metodologie didattiche attive più efficaci. (2020, January 31). Diario della Formazione. https://www.diariodellaformazione.it/editoriali/metodologie-didattiche-attive-efficaci/

Learn. (n.d.). In *Merriam-Webster*. Retrieved August 3, 2021, from https://www.merriam-webster.com/dictionary/learn

Learning. (2021, July 3). In *Wikipedia*. https://en.wikipedia.org/wiki/Learning

Learning Theories and Models. (n.d.). Learning Theories and Models. Retrieved August 3, 2021, from http://learningmodels.blogspot.com/p/learning-theories-and-models.html

Lopez Ruiz, L. (n.d.). *Non-formal education vs. Formal and informal education*. Traditional Wooden Constructions of Europe. Retrieved August 3, 2021, from http://trawcoe.com/non-formal-education-vs-formal-and-informal-education/

McGrath, W. E. (1978). Relationships between hard/soft, pure/applied, and life/nonlife disciplines and subject book use in a university library. *Information Processing & Management,* 14(1). https://doi.org/10.1016/0306-4573(78)90054-7

Mcleod, S. (2017, February 5). *Kolb's Learning Styles and Experiential Learning Cycle*. Simply Psychology. https://www.simplypsychology.org/learning-kolb.html

Mynbayeva, A., Sadvakassova, Z., & Akshalova, B. (2018). Pedagogy of the Twenty-First Century: Innovative Teaching Methods. *New Pedagogical Challenges in the 21st Century - Contributions of Research in Education*. Published. https://doi.org/10.5772/intechopen.72341

Nichols, M. (2003). A theory for eLearning. *Journal of Educational Technology & Society, 6*(2), 1-10.

Open Distance Education System. (2010, October 22). The E-Learning Index. https://elearningindex.wordpress.com/academic-work/distance-education-systems/open-distance-education-system/

Organisation for Economic Co-operation and Development, Taguma, M., Feron, E., & Lim, M. H. (2018, October). *Future of Education and Skills 2030: Conceptual Learning Framework.* https://www.oecd.org/education/2030-project/about/documents/Education-and-AI-preparing-for-the-future-AI-Attitudes-and-Values.pdf

Pedagogic theory. (n.d.). Information Literacy Website. Retrieved August 3, 2021, from https://infolit.org.uk/teaching/developing-your-teaching/pedagogic-theory/

Pedagogy. (2021, July 29). In *Wikipedia*. https://en.wikipedia.org/wiki/Pedagogy

Peel, E. A. (2020, October 29). Pedagogy. *Encyclopedia Britannica*. https://www.britannica.com/science/pedagogy

Piaget, J. (1964). Part I: Cognitive development in children: Piaget development and learning. *Journal of research in science teaching, 2*(3), 176-186.

Pietrzak, B., Ward, A., Cheung, M. K., Schwendimann, B. A., Mollaoglu, G., Duong, M. T., Ulltveit-Moe, N., Allareddy, V., Dutton-Regester, K., Zhang, J., Scult, M. A., Naz, S., Singh, P. C., Yan, H. Y., Isaacson, K., Dennis, A. F., Al-Humaidan, E. I., Beardsley, F. R., Lo, C., . . . Konstantinides, N. (2018). Education for the future. *Science, 360*(6396), 1409–1412. https://doi.org/10.1126/science.aau3877

Popa Strainu, R. M., & Georgescu, M. (2017). SOA – The Link Between Modern Educational Technologies and Mobile Learning in the Higher Education Landscape. *Timisoara Journal of Economics and Business, 10*(1). https://doi.org/10.1515/tjeb-2017-0008

Problem-Based Learning (PBL). (n.d.). University of Illinois. Retrieved August 3, 2021, from https://citl.illinois.edu/citl-101/teaching-learning/resources/teaching-strategies/problem-based-learning-(pbl)

Rinne, R., & Weiler, A. (n.d.). *Types of education systems*. YOUNG_ADULLLT. Retrieved August 3, 2021, from https://www.young-adulllt.eu/glossary/detail.php?we_objectID=217

Root, D. (2017, June 20). *Adult Learning Theory and Experiential Learning: A Recipe for Success*. Eagle's Flight. https://www.eaglesflight.com/blog/adult-learning-theory-and-experiential-learning-recipe-for-success

Rosell, C. D. (2020, July 17). *What is Blended Learning Method and how it works?* CAE Computer Aided E-Learning. https://www.cae.net/blended-learning-introduction/

Shalabi, M., Almuqati, A. N., & Same, M. (2018). Reflective Teaching as a Practical Approach. *Journal of Literature, Languages and Linguistics, 43*.

Siemens, G. (2005, January). *Connectivism: A Learning Theory for the Digital Age*. International Journal of Instructional Technology and Distance Learning. http://itdl.org/Journal/Jan_05/article01.htm

Skinner, B. (1974). Designing Higher Education. *Daedalus, 103*(4), 196-202. Retrieved August 3, 2021, from http://www.jstor.org/stable/20024262

Smith, M. K. & infed.org. (2015, April 6). *The encyclopedia of pedagogy and informal education*. Infed.Org. https://infed.org/mobi/what-is-education-a-definition-and-discussion/

Sutton, K. (n.d.). *Major theories and models of learning*. Lumen. Retrieved August 3, 2021, from https://courses.lumenlearning.com/educationalpsychology/chapter/major-theories-and-models-of-learning/

Tes. (2018, December 10). *What is pedagogy?* https://www.tes.com/news/what-is-pedagogy-definition

Theory of Knowledge. (2015). Garner Magnet High School. https://www.wcpss.net//site/Default.aspx?PageID=14468

Top Hat. (2019, September 16). *Education System Definition and Meaning*. https://tophat.com/glossary/e/education-system/

Types of Education: Formal, Informal & Non-Formal. (2020, May 6). ExamPlanning. https://examplanning.com/types-education-formal-informal-non-formal/

UNESCO. (2012). *International Standard Classification of Education ISCED 2011*. UNESCO Institute for Statistics. http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-isced-2011-en.pdf

Wallace, D. (2009). Parts of the Whole: Approaching Education as a System. *Numeracy, 2*(2). https://doi.org/10.5038/1936-4660.2.2.9

Westbrook J, Durrani N, Brown R, Orr D, Pryor J, Boddy J, Salvi F (2013) *Pedagogy, Curriculum, Teaching Practices and Teacher Education in Developing Countries*. Final Report. Education Rigorous Literature Review. Department for International Development.

What, Why, and How to Implement a Flipped Classroom Model. (n.d.). Michigan State University. Retrieved August 3, 2021, from https://omerad.msu.edu/teaching/teaching-skills-strategies/27-teaching/162-what-why-and-how-to-implement-a-flipped-classroom-model

Yadav, K. (2021, February 12). *Effective Pedagogical Approaches*. Evelyn Learning Systems. https://evelynlearning.com/effective-pedagogical-practices/

Yale. (n.d.). *Discussion Methods*. Poorvu Center for Teaching and Learning. Retrieved August 3, 2021, from https://poorvucenter.yale.edu/resources/teaching-techniques-and-methods/discussion-methods

2. Politecnico di Torino

Politecnico di Torino. (n.d.-a). *Masterplan - Progetti*. Retrieved August 3, 2021, from https://www.masterplan.polito.it/progetti

Politecnico di Torino. (n.d.-b). *Scoprire l'Ateneo*. Retrieved August 3, 2021, from https://www.polito.it/ateneo/

Politecnico di Torino. (n.d.-c). *Servizi per la didattica | Piano degli studi e programmi dei corsi*. Retrieved August 3, 2021, from https://didattica.polito.it/pls/portal30/gap.a_mds2018.init

Politecnico di Torino. (2018, November). *Piano Strategico 2018–2024*. https://www.pianostrategico.polito.it

Politecnico di Torino. (2019a, April 10). Inaugurato TLLab, il nuovo Teaching lab del Politecnico. *Poliflash Magazine*. https://poliflash.polito.it/in_ateneo/inaugurato_tllab_il_nuovo_teaching_lab_del_politecnico

Politecnico di Torino. (2019b, May 16). Proseguono gli incontri del TLLab: si è parlato della didattica innovativa in Ateneo. *Poliflash Magazine*. https://poliflash.polito.it/in_ateneo/proseguono_gli_incontri_del_tllab_si_e_parlato_della_didattica_innovativa_in_ateneo

Politecnico di Torino. (2020a, April 23). La TLLab Community è su Slack. *Poliflash Magazine*. https://poliflash.polito.it/in_ateneo/la_tllab_community_e_su_slack

Politecnico di Torino. (2020b, November 8). *Il Politecnico di Torino*. Biennale Tecnologia. https://www.biennaletecnologia.it/il-politecnico-di-torino

Politecnico di Torino. (2021a, January 22). "Learn to Teach L2T", la formazione per innovare la didattica. *Poliflash Magazine*. https://poliflash.polito.it/in_ateneo/learn_to_teach_l2t_la_formazione_per_innovare_la_didattica

Politecnico di Torino. (2021b, July 11). In *Wikipedia*. https://it.wikipedia.org/wiki/Politecnico_di_Torino

3. Design Analysis

Addis, V. (2019, October 3). *Why reviewing books is a good avenue for scholarly engagement*. Inside Higher Ed. https://www.insidehighered.com/advice/2019/10/03/why-reviewing-books-good-avenue-scholarly-engagement-opinion

Bischoff, A. (2021, January 7). *Customer journey map: What it is and why you need one*. Delighted. https://delighted.com/blog/guide-to-customer-journey-mapping

Boag, P. (2020, June 23). *Customer Journey Mapping: Your Definitive Guide*. Paul Boag - User Experience Advice. https://boagworld.com/audio/customer-journey-mapping/

Capytech. (2019, March 14). *What Is LXD – Learning Experience Design?* https://www.capytech.com/index.php/2019/03/14/what-is-lxd-learning-experience-design/

Collegial Peer Review Scheme. (n.d.). Western Sydney University. Retrieved August 25, 2021, from https://www.westernsydney.edu.au/learning_futures/home/21st_century_curriculum_project2/initiative_3._future_of_work/go/collegial_peer_review_scheme

Cooper, A. (2020, February 4). *The Long Road to Inventing Design Personas*. Medium. https://onezero.medium.com/in-1983-i-created-secret-weapons-for-interactive-design-d154eb8cfd58

Design education. (2021, March 12). In *Wikipedia*. https://en.wikipedia.org/wiki/Design_education

Extension Engine. (2018). *LXD: 10 Things To Know About Learner Experience Design*. Extension Engine Blog. https://blog.extensionengine.com/lxd-10-things-to-know-about-learner-experience-design/

Floor, N. (2018, March 8). *This is Learning Experience Design*. Linkedin. https://www.linkedin.com/pulse/learning-experience-design-niels-floor/

Geissinger, B., & Salem, L. (n.d.). *What does Peer Review mean? The Difference Between the Types of Journal Publications*. San Diego State University. Retrieved August 25, 2021, from https://libguides.sdsu.edu/c.php?g=728122&p=6645708

Gibbons, S. (2018, December 9). *Journey Mapping 101*. Nielsen Norman Group. https://www.nngroup.com/articles/journey-mapping-101/

Gonzalez Barra, G. (2020, March 17). *How to run simple and effective design reviews*. Medium. https://gabrielag.medium.com/how-to-run-simple-and-effective-design-reviews-cea848d28f1d

Great Schools Partnership. (2013, August 29). *Learning Experience Definition*. The Glossary of Education Reform. https://www.edglossary.org/learning-experience/

Herron, D. M. (2012). *Is expert peer review obsolete? A model suggests that post-publication reader review may exceed the accuracy of traditional peer review*. Surgical Endoscopy, 26(8), 2275–2280. https://doi.org/10.1007/s00464-012-2171-1

How to Write Academic Reviews - Academic Skills - Trent University. (n.d.). Trent University. Retrieved August 25, 2021, from https://www.trentu.ca/academicskills/how-guides/how-write-university/how-approach-any-assignment/how-write-academic-reviews

Journey Map | Service Design Tools. (n.d.). Service Design Tools. Retrieved August 24, 2021, from https://servicedesigntools.org/tools/journey-map

Kelly, J., Sadeghieh, T., & Adeli, K. (2014). Peer Review in Scientific Publications: Benefits, Critiques, & A Survival Guide. *EJIFCC, 25*(3), 227–243.

Kilgore, W. (2016, June 20). *UX to LX: The Rise of Learner Experience Design*. EdSurge. https://www.edsurge.com/news/2016-06-20-ux-to-lx-the-rise-of-learner-experience-design

Learning Experience Design - The Most Valuable Lessons. (2020, August 21). The Interaction Design Foundation. https://www.interaction-design.org/literature/article/learning-experience-design-the-most-valuable-lessons

Lightfoot, D. (2020, December 8). *How we conduct design reviews at Abstract*. Abstract. https://www.abstract.com/blog/conduct-design-reviews

Minton, T. (2019, September 18). *Design Review Process: How to Improve UX Team Collaboration*. Openfield. https://openfieldx.com/design-review-process-collaboration-productivity/

Noh, G. (2019, November 29). *Tips for your next design review*. Medium. https://medium.com/@gracesnoh/tips-for-your-next-design-review-a58c0bc9db44

Palmatier, R. W., Houston, M. B., & Hulland, J. (2017). Review articles: purpose, process, and structure. *Journal of the Academy of Marketing Science, 46*(1), 1–5. https://doi.org/10.1007/s11747-017-0563-4

Pardal, S. S. (2018, June 8). *Learning Experience Design: What You Need To Know*. ELearning Industry. https://elearningindustry.com/learning-experience-design-what-need-know

Peer review should be an honest, but collegial, conversation. (2020). *Nature, 582*(7812), 314. https://doi.org/10.1038/d41586-020-01622-z

Politecnico di Torino. (2021a). *Piano degli studi - Course structure*. Portale della Didattica. https://didattica.polito.it/pls/portal30/sviluppo.offerta_formativa_2019.vis?p_coorte=2022&p_sdu=81&p_cds=4

Qiany, S. (2020, September 24). *A Personas Guideline, From What They Are to How To Use*. Medium. https://uxdesign.cc/while-we-are-talking-about-personas-what-exactly-are-we-talking-525a645eb61a

Scherer, K. (2016, October 4). *How to make design reviews productive*. Vox Media Storytelling Studio. https://storytelling.voxmedia.com/2016/10/4/13150782/design-review-how-to

Scholarly Journal Publishing Guide. (n.d.). McGill Library. Retrieved August 25, 2021, from https://libraryguides.mcgill.ca/journalpublishing/typesofreview

Shapers. (2020, May 28). *Fundamentals of learning experience design*. Learning Experience Design. https://lxd.org/fundamentals-of-learning-experience-design/

Smyk, A. (2017, May 26). *How to Conduct a Design Review*. Adobe Blog. https://blog.adobe.com/en/2017/05/26/how-to-conduct-a-design-review.html#gs.9t1h7s

Sohal, J. S. (2019, January 9). *Learning Experience Design (LXD): Overview and Resources*. Linkedin. https://www.linkedin.com/pulse/learning-experience-design-lxd-elearning-its-great-jagdish/

Stanley, P. (2018, June 19). *How To Conduct "Engaging" Design Reviews*. Medium. https://thedesignteam.io/how-to-conduct-engaging-design-reviews-11e60adba412

Thayer, N. (2019, January 14). *How to Present a Design Review*. Carbon Five. https://blog.carbonfive.com/how-to-present-a-design-review/

The Interaction Design Foundation. (n.d.). *What are Customer Journey Maps?* Retrieved August 24, 2021, from https://www.interaction-design.org/literature/topics/customer-journey-map

University of Calgary. (2015). *Design Reviews*. http://people.ucalgary.ca/~design/engg251/First%20Year%20Files/design_reviews.pdf

Vera, R. (2020, May 18). *"Personas": La herramienta para el Diseño de Interacción de Alan Cooper*. Blog IDA Chile. https://blog.ida.cl/diseno/personas-el-diseno-de-interaccion-segun-alan-cooper/

Weigel, M. (2015, April 15). *Learning Experience Design vs. User Experience: Moving From "User" to "Learner."* Getting Smart. https://www.gettingsmart.com/2015/04/learning-experience-design-vs-user-experience-moving-from-user-to-learner/

What is peer review? (n.d.). Elsevier. Retrieved August 25, 2021, from https://www.elsevier.com/reviewers/what-is-peer-review

What is the difference between scholarly and peer reviewed journals? (2021, June 30). Northcentral University Library. https://ncu.libanswers.com/faq/168491

4. Course Design

Arts Instructional Support & Information Technology. (n.d.). *Ideas and Strategies for Peer Assessments*. The University of British Columbia. Retrieved August 27, 2021, from https://isit.arts.ubc.ca/ideas-and-strategies-for-peer-assessments/

Bannister, D., MBE. (2017, December). *Guidelines on Exploring and Adapting Learning Spaces in Schools*. European Schoolnet. http://files.eun.org/fcl/Learning_spaces_guidelines_Final.pdf

Boon, S. (2020, January 29). *Using peer assessment as an effective learning strategy in the classroom*. Impact Chartered College. https://impact.chartered.college/article/using-peer-assessment-effective-learning-strategy-classroom/

Boud, D. (2002). *What is Peer Learning and Why is it Important?* Stanford University. https://tomprof.stanford.edu/posting/418

Boud, D., Cohen, R., & Sampson, J. (1999). Peer Learning and Assessment. *Assessment & Evaluation in Higher Education, 24*(4), 413–426. https://doi.org/10.1080/0260293990240405

Calin, A. (2019, January 7). *Four Strategies to Enable Peer Learning for Your Employees*. Hubgets Blog. https://www.hubgets.com/blog/strategies-peer-learning-employees/

Center for Teaching Innovation. (n.d.). *Peer Assessment*. Cornell University. Retrieved August 27, 2021, from https://teaching.cornell.edu/spring-teaching-resources/assessment-evaluation/peer-assessment

Debby Ellis Writing Center. (n.d.). *Directing Student Revision*. Southwestern University. Retrieved August 27, 2021, from https://www.southwestern.edu/offices/writing/faculty-resources-for-writing-instruction/peer-review/directing-student-revision/

Guertin, L. (n.d.). *How to Use Peer Review*. Science Education Resource Center. Retrieved August 27, 2021, from https://serc.carleton.edu/sp/library/peerreview/how.html

How to Make Peer Review Successful. (2018, December 20). The Graide Network. https://www.thegraidenetwork.com/blog-all/2018/12/20/how-to-make-peer-reviews-successful-part-1-of-2

Indiana University Bloomington. (n.d.). *Developing Learning Outcomes*. Center for Innovative Teaching and Learning. Retrieved August 26, 2021, from https://citl.indiana.edu/teaching-resources/course-design/developing-learning-outcomes/index.html

Iowa State University. (n.d.). *Peer Assessment*. Center for Excellence in Learning and Teaching. Retrieved August 27, 2021, from https://www.celt.iastate.edu/teaching/assessment-and-evaluation/peer-assessment/

Johnson, J. (2018, March 8). *What is Learning Experience Design and Why Is It Important?* Linkedin. https://www.linkedin.com/pulse/what-learning-experience-design-why-important-james-johnson/

Johnston, J. & NCE-MSTL. (2009). How to Implement Peer Learning in Your Classroom. *Resource & Research Guides, 1*(7). http://eprints.lincoln.ac.uk/id/eprint/19430/1/How+to+Implement+Peer+Learning+in+Your+Classroom.pdf

Lee, Y. S. (2010). Functional Criticism: A Guide to Critiques in the Graphic Design Classroom. *Design Principles and Practices: An International Journal—Annual Review, 4*(1), 401–408. https://doi.org/10.18848/1833-1874/cgp/v04i01/37809

Mulder, R., Pearce, J., Baik, C., & Payne, C. (2012). *Guide to Student Peer Review*. The University of Melbourne. http://peerreview.cis.unimelb.edu.au/wp-content/uploads/2012/06/Academic-guide-FINAL.pdf

Peer assessment - Engage in Assessment. (n.d.). University of Reading. Retrieved August 27, 2021, from https://www.reading.ac.uk/engageinassessment/peer-and-self-assessment/peer-assessment/eia-peer-assessment.aspx

Peer review. (2021, August 20). In *Wikipedia*. https://en.wikipedia.org/wiki/Peer_review

Plaut, A. (2014, January 30). *Elements of Learning Experience Design*. Boxes and Arrows. https://boxesandarrows.com/elements-of-learning-experience-design/

Sampson, J., Boud, D., Cohen, R., & Gaynor, F. (1999, July). *Designing Peer Learning*. HERDSA Annual International Conference, Melbourne, Australia.

Sancassani, S., Brambilla, F., Casiraghi, D., & Marenghi, P. (2019). *Progettare l'innovazione didattica*. Pearson.

Share to Know. (2016). *Share to Know: Furthering peer-to-peer and collaborative learning methods*. The Young Foundation. https://youngfoundation.org/wp-content/uploads/2017/02/Share-to-Know-summary-guide.pdf

Stančić, M. (2020). Peer assessment as a learning and self-assessment tool: a look inside the black box. *Assessment & Evaluation in Higher Education, 46*(6), 852–864. https://doi.org/10.1080/02602938.2020.1828267

University of the People. (2020, November 18). *Collaborative And Peer to Peer Learning*. https://www.uopeople.edu/student-experience/quality/collaborative-peer-peer-learning/

University of Toronto. (2015, August 19). *What Are Learning Outcomes?* Centre for Teaching Support & Innovation. https://teaching.utoronto.ca/teaching-support/course-design/developing-learning-outcomes/what-are-learning-outcomes/

University of Waterloo. (2020, June 9). *Using Student Peer Review in Any Class* Centre

for Teaching Excellence. https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching-tips/teaching-tips-assessing-students/using-student-peer-review-any-class

UNSW Teaching Staff Gateway. (2019, February 28). *Student Peer Assessment*. UNSW Sydney. https://teaching.unsw.edu.au/peer-assessment

Valamis. (2020, June 17). *Learning Outcomes: Types, Examples, Verbs*. https://www.valamis.com/hub/learning-outcomes

Wagner, R. (2018, November 27). *Peer Review Reviewed*. Inside Higher Ed. https://www.insidehighered.com/advice/2018/11/27/making-student-peer-review-effective-classroom-technique-opinion

Washinton University in St. Louis. (2021, March 1). *Planning and Guiding In-Class Peer Review*. Center for Teaching and Learning. https://ctl.wustl.edu/resources/planning-and-guiding-in-class-peer-review/

5. Case Study

Chicago Architecture Center. (2019). *DiscoverDesign Handbook*. DiscoverDesign. https://discoverdesign.org/handbook

Dam, R. F., & Siang, T. Y. (2021, January 2). *5 Stages in the Design Thinking Process*. The Interaction Design Foundation. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process

Mind Tools Content Team. (n.d.). *SWOT Analysis: How to Develop a Strategy For Success*. Mind Tools. Retrieved August 30, 2021, from https://www.mindtools.com/pages/article/newTMC_05.htm

Oz, O. (2019, December 13). *UX Design Processes*. UX Beginner. https://www.uxbeginner.com/ux-design-processes/

Portale della Didattica - Componenti del Prodotto. (n.d.). Politecnico di Torino. Retrieved August 30, 2021, from https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=02JMHPO&p_a_acc=2022&p_header=S&p_lang=IT

Queensland Government. (2016, June 22). *SWOT analysis*. Business Queensland. https://www.business.qld.gov.au/starting-business/planning/market-customer-research/swot-analysis

Schooley, S. (2019, June 23). *SWOT Analysis: What It Is and When to Use It*. Business News Daily. https://www.businessnewsdaily.com/4245-swot-analysis.html

Shewan, D. (2021, March 16). *How to Do a SWOT Analysis for Your Small Business (with Examples)*. WordStream. https://www.wordstream.com/blog/ws/2017/12/20/swot-analysis

Urse, A. (2021, February 6). *The curse of the UX design process*. Research Loop. https://researchloop.net/2021/02/06/the-curse-of-the-ux-design-process/

Figures

Annex 1

Deck of cards of the new learning experience.

Classroom Frontal Lesson

Course Introduction

Presentation of the course's topics, calendar, goals and class project. Explanation of the different channels available for students and teachers to connect.

MATERIAL Presentation on the course structure

CHANNELS Class community to share presentations and resources

1

Classroom Frontal Lesson

Design by Components

Introduction to design by components; its utility and methods, providing examples and case studies.

MATERIAL Presentation to support the explanation

Examples and case studies

CHANNELS Class community to share presentations and resources

2

Fablab

Field Work

Fablab Presentation

Guided visit of the Fablab and introduction to open design, making emphasis on its role in maker spaces. Students are encouraged to explore the Fablab space, talk with makers and start their research while teachers are available to solve doubts.

MATERIAL

Presentation on open design

Fablab's floor plan to describe the space

CHANNELS

Class community to share presentations and resources

3

Classroom

Frontal Lesson

Intro to Peer Reviews

Introduction of peer reviews and their importance in the learning process as well as in design projects. Demonstration of feedback construction with examples given by the teacher an exercises in which the whole class participates and a set of guidelines is created for future reviews.

MATERIAL

Presentation with examples

Mock projects to exercise feedback construction

CHANNELS

Collaboration platform to interact with projects and participate in the creation of review guidelines

4

Classroom Group Work

Peer Reviews

Peer review groups get together to assess each others work and apply their reviewing knowledge. After group reviews teams get together to analyze the comments received, write down observations on their peers' reviews and make decisions about the next steps they will take.

MATERIAL

Project presentation

Worksheet with peer review guidelines

Worksheet to guide teams in strategy construction from feedback received

CHANNELS

Collaboration platform to visualize presentations, and interact with them through comments and annotations

Classroom Frontal Lesson

Goal Setting for Reviews

Explanation of the importance of goal setting for effective design reviews and the methodology to do so, accompanied by examples that show the way goals modify feedback received. Team exercise setting goals for the project and the next review.

MATERIAL

Presentation with examples and exercises

Worksheet to guide teams in the goal setting process

CHANNELS

Collaboration platform to solve exercises collectively, interacting with the material

Classroom Frontal Lesson + Group Work

Product Analysis

Teachers give a general explanation of the topics in which teams should be working for the next few weeks; providing them with the necessary tools and resources to do so. Teams work on their projects while teachers remain available to solve doubts and questions.

MATERIAL

Presentation on product analysis by components and the relationships that bind them

CHANNELS

Class community to share presentations and resources

Classroom Group Work

Peer Reviews

Peer review groups get together to assess each others work. Peers give feedback on the work presented and help teams achieve their goals for the review. Later, teams get together to analyze the comments received, write down observations on their peers' reviews and make decisions about the next steps they will take.

MATERIAL

Project presentation

Goals and priorities for the review

Worksheets to guide teams in reviews and construction of strategies

CHANNELS

Collaboration platform to visualize presentations, and interact with them through comments and annotations

Classroom Group Presentations

Design Concept Presentation

Teams briefly present the results of their work, up to the date. Ideally all teams have a clear design concept that has emerged from their analysis, however some may still need to work on it. It is a space for students and teachers to assess the general situation and find support of more advanced teams.

MATERIAL Project presentation

CHANNELS Class community for teams to communicate and find help from classmates

Classroom Group Work

Generation of Ideas

Teams work on generating ideas to find design solutions while teachers are available to solve doubts and give explanations on specific topics per students request. Reviews with teachers from parallel courses can be set up to guide students with doubts in particular subjects.

MATERIAL Project design concept

CHANNELS Class community to find and solve common doubts

Collaboration platform for teams to work together; share, display and connect ideas

Classroom Group Work

Peer Reviews

Peer review groups get together to assess each other's sketches, moodboards, models and other material to display their design solutions. Peers give feedback on the work presented and help teams achieve their goals for the review. Afterwards teams set strategies based on the comments received.

MATERIAL

Project presentation, sketches and models

Goals for the review

Worksheets to guide teams in reviews and construction of strategies

CHANNELS

Collaboration platform to visualize presentations, and interact with them through comments and annotations

Classroom Group Presentations

Design Solution Presentation

Teams briefly present the results of their work, up to the date. Ideally all teams are concluding the ideation phase and have a final design solution, however some may still need to work on it. It is a space for students and teachers to assess the general situation and find support of more advanced teams.

MATERIAL

Project presentation

CHANNELS

Class community for teams to communicate and find help from classmates

Classroom / Fablab

Group Work

Prototype Development

Teams work on developing and constructing a prototype while teachers are available to solve doubts and give explanations on specific topics per students request. Reviews with teachers from parallel courses can be set up to guide students on particular subjects.

MATERIAL

Final design solution

Materials and tools for prototype construction

CHANNELS

Class community to find and solve common doubts

Classroom

Group Work

Peer Reviews

Peer review groups get together to assess each other’s prototypes. Peers give feedback on the work presented and help teams achieve their goals for the review. Afterwards teams get together to analyze the comments received, write down observations on their peers’ reviews and make decisions about the next steps they will take.

MATERIAL

Project presentation, models and prototypes

Goals for the review

Worksheets to guide teams in reviews and construction of strategies

CHANNELS

Collaboration platform to visualize presentations, and interact with them

Teacher's Office + Class Community

Presentation Preparation

Teams work outside of the classroom finishing their prototypes and constructing the final presentation to present their work and process. If needed reviews with teachers can be organized to solve specific doubts, however the digital community networks are always open for teams to consult with their peers and get feedback on their work through these channels.

MATERIAL Project presentation and prototypes

CHANNELS Class community to discuss, share doubts and ideas, solve questions, and share resources

Classroom Group Presentations

Final Project Presentation

Teams present the final project to the whole class; explaining their process and results. Peers can view their influence their classmate's work and teachers can assess the success of the learning experience on the project outputs.

Peers, teachers and guests give qualitative feedback on the work presented by teams. Assessment is constructed based on self-evaluations, peer-evaluations and teacher-evaluations.

MATERIAL Project presentation
Team's worksheets to show their process in the course