

Exploring Innovation in the Teaching of Design. A Study on the Experimental Teaching Practices in the Context of a School of Design

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Abstract. Teaching innovation research aims to experiment with new practices and methodologies that relate objectives, activities, tools, and other elements to respond to new educational challenges, such as equipping students with the right skills for increasingly complex and changing work contexts. For higher education institutions, innovation of didactic is an increasingly strategic goal to prepare students for jobs that do not yet exist and to be competitive with emerging players in the educational context. This article outlines a funded research project investigating the perimeter of innovation in design education. The research focuses on the context of the Politecnico di Milano to understand how experimentation in university courses can lead to innovation in design education. The paper presents a survey definition process aiming to map experimentation practices in courses over the past decade and how the results of this mapping can define potential models for codifying and defining teaching practices with innovation potential.

Keywords: Design education, Experimental teaching practices, Instructional design, Innovative teaching

1 Introduction

Design is a field of knowledge broadly hinged into practice. Coherently, design education widely employs a project-based learning approach, providing a context that places students with an active role at the centre of the learning process. Therefore design teaching may appear very cutting-edge in the current debate around the innovation of teaching practices in higher education, which often focuses on leaving the traditional ex-cathedra approach in favour of students-centred models aimed at fostering active learning. Does this already highly active nature aligned with the constructivist learning paradigm, therefore, exempt the design discipline from updating its teaching practices?

In 2001, Findeli asserted the need to rethink design education to meet the needs of the 21st century [1], which is also confirmed by the rapid evolution of the design discipline in light of socioeconomic changes [2]. Teaching innovation is here intended as the constant evolution of a learning environment to improve the learning experience [3]. However, what is considered innovative in one situated context or disciplinary area might be already well established in others [4]. Therefore the Innovation in Design Teaching (IDT) was initially conceived and later funded to map the current teaching practices experimented with and implemented in the situated context of the School of Design of the Politecnico di Milano.

The first part of this article investigates from a theoretical point of view the methods, approaches and trends of innovation in the field of higher education teaching and in particular, design education to build the theoretical framework on which the subsequent process of investigation, analysis and mapping of experimental practices in a situated context that could represent possible innovation in the field of teaching in design is based. In order to better understand how these innovations fit into design education, which is already characterised by learning that is heavily problem- and project-based, an investigation of supra- and macro (international and national) innovations that appear to be moving away from an objectivist approach to learning toward a more active approach that puts students at the centre, or constructivism, will first be made. Identifying and analysing teaching practices in the selected setting to determine which ones are changing, why, and how. This exploratory study also aims at developing and making accessible to lecturers self-reflective tools for directing action research and recording all the experimental practices that have innovation potential.

2 Theoretical background

2.1 The Innovation of Teaching Practices

The paradigmatic shift from an objectivist to a constructivist view on learning is prompting an increasing innovation in formal education. Indeed in the education domain, numerous theories have been developed to explain teaching, learning, and the nature of knowledge [5]; objectivism and constructivism might be considered the two main opposite theories of education [5], [6]. Objectivism assumes that reality and knowledge exist independently of the knower; hence, the teacher's role is to transmit content to the learner who receives them. Constructivist theories assume that knowledge comes from a personal meaning-creation process [6], [7], [8]; accordingly, reality and knowledge are considered the results of the learner's construction through experience rather than absolute truths. Specifically, knowledge is collectively constructed by the learner through social interactions and cognitive processes in the learner's mind [9]. The constructivist theorisation of learning has now become established in psycho-pedagogical research, thus influencing the processes of organising teaching [10] and the way educators design instruction [11].

In this emerging learning paradigm, instruction innovation heavily depends on a continuous cycle between action and research. The constructivist view on learning underlies that learning and teaching are complex phenomena, hardly explainable through rational logic since individual, experiential, contextual and social factors influence them. In this scenario, contemporary instruction design is increasingly based on the logic of complexity [10], in which the instructional design process is conceptualised as an ongoing interaction between planning and acting. Instructional design entails designing the learning experiences to foster students' learning towards the aimed strategic objectives. There is no defined chronological sequence but rather a shift of the instructional designer between reflection and action [10], [12]. Given the close intertwining between action and design, instructional design and education strongly rely on action research [13], [14], [15]. Action research is therefore employed in the instruction field as a practice-changing practice [13], [14], [16], allowing the teacher to continuously evaluate their setting to improve instructional

design and teaching practices, with the ultimate goal of enhancing their students' learning [13].

The close relationship between research and action in the instructional design domain highlights the situated nature of this field of knowledge. Action research “involves learning about the real, material, concrete, particular practices of particular people in particular places” [14] and is, therefore, necessarily situated. Hence, this approach allows to act and change situated instructional practices, contributing to building a body of knowledge that informs the establishment of effective practices [16]. However, action research is being criticised as it hardly leads to developing generalisable knowledge applicable to different educational settings. Indeed action research should be regarded as an approach that emphasises the usefulness of the inquiry results to one's practice [13], although it is unlikely to lead to the development of generalisable theories. Understanding how teaching practices are evolving and innovating through teachers' actions can provide an essential indication of emerging needs and approaches in the situated context (i.e., disciplinary, national, local, institutional) in which they are implemented. Monitoring and understanding the actions undertaken in a specific educational context also support understanding the change and evolution of teaching practices within that same context. Indeed, didactic innovation can be understood as a continuous evolution of an educational context aimed at improving the learning experience, which presents characteristics that are transferable to other contexts and can thus take on value in the broader educational community [3].

According to Castoldi [10], in the reflection on instructional change, three relationships between research and improvement exist i) research on the improvements, ii) research for improvement and iii) research as an improvement. Research on the improvements (i) means the inquiry does not determine the change of teaching practices but provides helpful feedback for its management. Thus, an external relationship is established between research and innovation, which remain separate and parallel processes. Research for improvements (ii) means that the research activity is a preliminary step to trigger the teaching practices' change process; research and innovation are complementary processes, two components of a single path. Research as an improvement (iii) means that the research activity is identified with the process of change insofar as it reflects and produces a change in professional behaviour and teaching practices; research and innovation are equivalent as they represent two sides of the same path. This perspective emphasises the assumption of self-reflective working methods in instructional actions for change and therefore is identified by Castoldi as most coherent with the action research paradigm. However, the lack of proper self-reflective methods might jeopardise the possibility of reconducting any action in a research instance.

Therefore, in a situated context, the instructional design innovation process might be tracked by understanding different forms of curricula innovation. Curricula can be defined as “a plan for learning” [17], and curricula can assume three distinct but interrelated forms: the intended, implemented and attained curriculum [17]. The intended curriculum represents the formal written plan that presents the intentions of a particular instructional project. The implemented curriculum represents the operational plan as enacted in the classroom and perceived by the teacher. Finally, the attained curriculum represents learners' outcomes and their experiential perception. Building on these curricula forms, Tassone et al. [18] define intended, implemented and attained innovations as distinct forms of innovation of the three curricula forms.

Consequently, intended innovations are proposed in course design plans and are meant to be pursued; implemented innovations are those deployed by educators in practice; attained innovations are the results achieved through innovations [18].

Following the terminology proposed by Tassone et al., the IDT project has been conceived and funded to map the already implemented curricula innovations in the context of the School of Design; the present article exclusively focuses on this type of curricula innovation. Specifically, the research focuses on teaching practices that are “the specific actions and discourse that take place within a lesson and that physically enact the approach and strategy” [19].

Teaching practices and implemented curricula components are here represented by building on the visual model of the spiderweb initially proposed by van den Akker [20] and component simplification in light of the proposal of Tassone et al. [18] (see Fig.1). investigation. The rationale is positioned at the model’s centre, connecting all the other components: aims and objectives, content, learning activities, materials and resources, grouping, location, time, and assessment. These components are here intended as components of teaching practices under The spiderweb symbolises the interconnectivity of teaching practice components and the framework’s fragility that connects them [17]. In other words, component accents may alter within a single curriculum over time, but any drastic movement in balance would throw the whole out of sync. Hence, curriculum implementation or redesign must focus on the balance and interdependence of these components [17]. According to Tassone et al. [18], these components help analyse innovations as intended and, most important for the present research, as implemented.

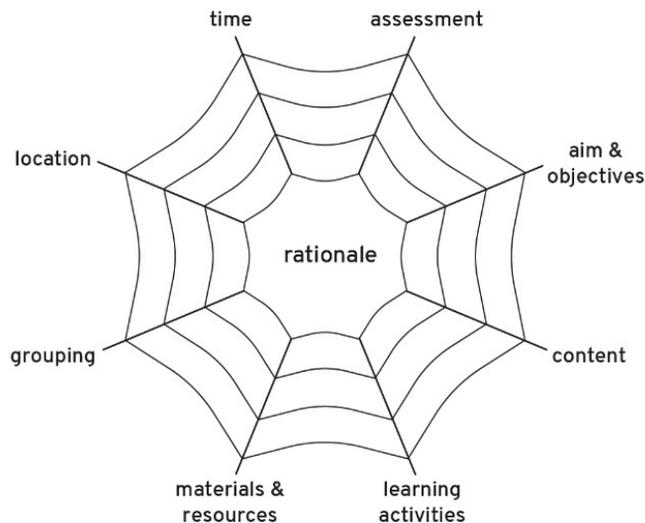


Fig. 1. Curricular spiderweb proposed by van Der Akker and adapted based on Tassone et al.

Finally, it is worth mentioning that the discussion around curricula might refer to different levels; namely, i) the international or supra level; ii) the national or macro level; iii) the institutional or meso level; iv) the classroom or micro level; v) the individual or nano level [21]. When discussing curricular activities (e.g. design and development; evaluation and implementation; policy-making), the distinction between curriculum levels has shown to be highly effective [21] and will also be helpful, later in the article, to disclose the unique position of the design curricula in the situated context under investigation.

2.2 Design Education and Constructive Learning: the Instructional Culture of the Studio and the Project

The first formal recognition of industrial design (from now on design) as a taught discipline dates back to 1919, with the foundation of the Bauhaus School in Weimar. Design as a discipline had to find its position within the two dominant paradigms of arts and sciences [2]. Accordingly, the Bauhaus instruction aimed to stimulate learning about designing at the intersection of art, technology and science [1]. The instructional approach adopted was inherited from the older and well-established discipline of Architecture and grounded on the design studio and the project, two essential teaching resources to foster learning [22].

The design studio represents the physical and interactional place where the instruction occurs. It usually is an open space or a large room where students are free to develop their design projects by interacting with others (e.g., teachers, technicians, students) and with physical materials (e.g., tools, drawings, prototypes) [22], [23], [24]. The development of the project is the main activity within the design studio. A well-established way to design education is learning via the experience of solving open-ended problems (i.e., projects). Project-based learning is a specific type of problem-based learning [25], [26], [27], where learning is conveyed via actively tackling a problem given by educators [3], [28]. Compared to other types of problem-based learning, project-based learning poses problems entrenched in realistic, open-ended, hands-on learning settings [25], and the solution (i.e., the project) is a form of anticipation of the future [29]. In other words, the problem is open-ended and ill-defined [30], [31], comparable to real-world design difficulties [32]. The nature of the problem suggests that no single solution exists [31], and the learner is cast as an active participant in developing solutions through actions and reflections [33], as design practitioners would do [34]. The origins of project-based learning may be found in architectural education as early as the 16th century and have been theorised under several titles, including Dewey's experiential learning, Montessori's free exploration, and Piaget's constructivism [22].

According to a constructivist viewpoint, knowledge and competences are produced in the studio through the design process; reflection and social engagement with peers and teachers improve cognitive performance [12], [35], [36]. The two pillars of the studio and the project have become defining approaches to disciplinary education in most design schools' instructional strategies, but not the only ones. Some scholars argued that the studio and the project do not fully capture the nature of the design education instructional approach [37]. For instance, theoretical notions within design curricula might still be hinged in more traditional ex-cathedra lectures, an instructional strategy more compliant with an objectivist view on learning. However, we assume that the relevance of the design studio pedagogy and the project-based approach strongly characterise design education and, therefore, influence its instructional culture.

2.3 Contextual Background and Research Proposition: Exploring Experimental Teaching Practices in Design Education

Understanding innovation in education needs to be situated in a specific context, as "what is an innovation in one context may well be traditional practice in another" [4]. A contextual specification is now beneficial to clarify the present study's perspective. Specifically, one of the intended curricula innovations at the supra and macro levels

(international and national) might be related to changing instruction from the traditional transmission of content by the teacher (i.e., objectivist approach to learning) toward a more active approach that puts students in the centre (i.e., constructivist approach to learning). If this is the case, teaching practices in design education might appear already innovative. Indeed, as mentioned in the previous paragraph, design pedagogy is already strongly characterised by problem and project-based learning, which are often identified as powerful approaches to foster learning within the constructivist paradigm.

Similarly, the research was initially motivated by identifying a disconnection between the teaching innovation policies at the meso level (i.e., the university level) and the micro level (i.e., the classroom within the School of Design). Based on contextual research, it emerged that, in the last years, the intended innovation of curricula at Politecnico di Milano mainly focused on changing teaching practices from traditional lecturing to more student-centred processes. Such approach change would encompass students' active involvement in supportive environments, exploitation of opportunities in the digital world, appropriate formative assessment strategies and promotion of students' creative potential [3]. This policy emerged as one crucial innovation to implement in many engineering curricula - numerically the largest in our institution. Conversely, the School of Design already extensively and structurally includes active learning, the cornerstone of the project-based approach. All of the above does not mean that design teaching practices are not changing or evolving, but that the contextual characteristics of design education and teaching approach already respond to some of the significant intended curricula innovation at a supra, macro and meso level. What teaching practices are changing, why and how they are changing in our situated context are questions still to be extensively addressed. The difficulty in answering these questions also lies in the lack of rigorous self-reflective methods to drive action research. In other words, teachers develop and implement experimental practices without necessarily formalising them, limiting the possibility of formulating these changes as research - or, in Castoldi's words, "research *as an improvement*". For this reason, the present study represents an initial contextual exploration in the form of research *on* the improvements. To this extent, the IDT was proposed and funded to map the existing practices related to implemented curricula innovation taking place in a situated context of the School of Design of the Politecnico di Milano, which represents a possible innovation concerning the disciplinary context of design. More specifically, the research focuses on the changes in teaching practices within the last few years. It is now necessary to make a lexical clarification. Although, as explained above, teaching innovation is defined as change, the word 'innovation' often ends up as a buzzword, especially in the context of industrial design, which also carries the meanings of improvement, efficiency, and performativity. Therefore, in exploring these teaching practices, it was chosen to call them 'experimental' for this research to characterise them by their empirical and explorative nature. The research questions that drove this contextual exploration are summarised as follows:

- What rationales prompt design educators to experiment with and implement new teaching practices in the situated context?
- Which components are changing within these experimental teaching practices?
- How might we support design educators to self-reflect and report their implemented teaching practices in the future towards the paradigm of research *as an improvement*?

The research aims to investigate the already implemented changes in teaching practices to understand how design teaching and learning are currently evolving. The developed knowledge may be insightful beyond the stakeholders within the context. It provides insights on methods to map teaching innovation, motivations that challenge teachers to review their practices, and how they are changing them and presenting those implemented changes. Beyond the contextual results, the present contribution proposes a methodology to understand how situated learning ecosystems are evolving through emerging teaching practices, hence providing a methodology to extend the inquiry to other contexts or focusing on the role of smart technologies in shaping this evolution. Therefore, the article should be intended as a meta-level contribution that proposes a design-based method to inquiry about learning ecosystems evolution.

3 Methodology

3.1 Open Survey for Design Lecturers

The main method chosen for the research was based on the collection and qualitative analysis of past experimental teaching practices implemented within the School of Design at Politecnico di Milano. The data collection aimed to make what is being done and the teachers' narrative of practices emerge.

To collect the teaching practices, a survey titled “*Experimental teaching practices in the School of Design*” was disseminated in June 2022 to all lecturers of the School of Design. The lecturers were invited to reflect on the experimental practices they devised and tested in the voluntary compilation. The collected data formed the basis for the analysis to map experimental teaching practices and the implemented innovations [15] within the context. As mentioned above, with the term *teaching practice*, the authors intended any action teachers took to modify their teaching approach. This might be related to integrating different approaches, activities, and assessment strategies and modifying the intended learning outcomes that the course aimed to achieve. Such a concept was explicitly defined at the beginning of the questionnaire. Talking about teaching practices allowed the researchers to leave room for the teachers' open narrative of experimental practices, freely connecting them with the different components of the teaching and, consequently, the learning experience.

The survey was divided into three distinct sections; namely, i) the personal data section, ii) the context of the teaching practice section, and iii) the teaching practice section. After the third section, one last section (i.e., other practices you would like to share) was added to redirect the respondents to previous sections in case they wanted to share another teaching practice. The first section (i) aimed at collecting personal information and consent to the use of data within the research project, which helps profile responding faculty members. The second section (ii) was dedicated to describing the context in which the experimental teaching practice was embedded (e.g. degree programme, course type).

Table 1. Participants had to evaluate components in the survey item (i.e., “*evaluate the aspects that your experimental teaching practice modifies compared to your previous practices*”). The nine components correspond to the curricular spiderweb, and the descriptions are retrieved by Tassone et al. [15, p. 8].

Codes	Description
Rationale	We aimed to change the reasons why students learn
Objectives	We aimed to change the objectives towards which students learn
Content	We aimed to change what students learn (e.g., theories, skills)
Activities	We aimed to change how students learn (e.g., lectures, fieldwork)
Materials and Resources	We aimed to change with what students learn, both considering resources in i) digital format (e.g., video clips); ii) non-digital format (e.g., articles)
Grouping	We aimed to change with whom students learn (e.g., alone, in groups)
Location	We aimed to change where students learn (e.g., home, classroom)
Time	We aimed to change when students learn (e.g., prior to class, after class)
Assessment	We aimed to change how students are assessed (e.g., multiple-choice tests, field performance)

In the third section (iii), lecturers were asked through open questions to describe their experimental teaching practice and to explain the reasons for initially experimenting with it (e.g., a need to update course contents, a change in teaching team members, numerical or spatial constraints, previous student feedback, or just a desire to experiment something new). In the last question, lecturers were required to self-assess the practice described in several aspects by expressing whether they were relevant. Specifically, the self-assessment was developed through a Likert scale for teachers to evaluate to which extent each of the nine components (see tab.1) was modified through the experimental teaching practice compared to previous ones. The participants were asked to grade each component-related description using a 5-point scale, from “strongly disagree” to “strongly agree”. As explained later in the paragraph, the quantitative self-assessment done by participants in this survey item was crucial to be cross-referenced with the qualitative coding using the same components of the descriptive accounts of the experimental teaching practice.

3.2 Coding Strategy

The goal of the analysis was to explore the ecosystem of the School of Design (people and context) to identify and analyse experimental teaching practices and identify potential clusters of teaching practice change and innovation within the narratives. Two different data portions have been analysed qualitatively through two different coding strategies. The coding employed two simultaneous coding methods, namely i) initial coding to analyse the rationales and ii) hybrid coding to analyse the components of the practice, as the goal of the analysis of teachers’ accounts was to bring out both the reasons for the experimentation and what components of teaching practices had changed. Transcripts were coded using MAXQDA, the Computer-Assisted Qualitative Data Analysis Software used for the analysis. The portion of the data corpus obtained by the written descriptions of the rationales behind the implementation of the experimental teaching practices was systematically coded

through initial coding (i). Initial coding, often called open coding, is a technique that tries to separate qualitative data into smaller portions, broken down into codes that embed the meaning association construct while being analysed and interpreted by the researcher [38]. The codes have been interpreted and clustered into recurring themes in a second cycle. Examples of emerging themes are 'STUDENTS PARTICIPATION', 'SOFT SKILLS DEVELOPMENT' and 'PROFESSIONAL READINESS'. The data corpus obtained by the written descriptions of teaching practices was analysed using a hybrid coding schema (ii), namely by coding the data following a predetermined set of codes [38] that descended directly from the components also used for the self-assessment (see Tab. 1) excluding the code 'RATIONALE' - already analysed separately through initial coding. For example, the following sentence was coded as 'GROUPING':

Fifty students in the course were divided into groups of four. The groupings were made autonomously by students, with instructions to include, if possible, at least one Erasmus - or international - student in each group [Participant 33].

The purpose of using these codes was to trace and observe the emergence of recurrences and relationships in the described experimental practices about the chosen codes to eventually relate them to the results of the self-assessment compiled by the lecturers. In this way, it was possible to analyse the components emerging from the coding of the text descriptions in light of the results obtained from the self-assessment carried out by the participants about the same components. In the hybrid coding, a set of predetermined codes was used to map the emergence of the different teaching practice components from teachers' accounts. This data analysis allowed the research team to identify which components emerged more or less prominently and the relation between them. To this extent, after the coding, a map showing the proximity of the codes was developed and interpreted.

4 Results

4.1 Ecosystem of Actors and Courses of Experimental Practices

After being sent to over 500 lecturers, the survey was completed by 47 participants. Most participants described only one teaching practice (n=42), a few described two (n=4), and one contributed by describing three of them. In total, 53 experimental teaching practices were collected and analysed. The first section of the survey, dedicated to personal data, shows that of the total number of respondents, 22 are adjunct professors (i.e., contract lecturers), 15 are associate or full professors, 9 are junior or senior researchers, and 1 is teaching assistant.

Table 2. Description of the types of courses offered by the School of Design and numerical distribution of experimental teaching practices collected on these various types.

N. practices	Course type	Description
24	Design Studio or Workshop	They are mandatory courses characterised by the development of project activities by students under the guidance of the teaching team, each of which offers its disciplinary content applied to the project theme.
6	Integrated Course	They are mandatory courses characterised by more than one discipline or specific area of knowledge, sometimes taught by two or more teachers who integrate their contributions.
8	Monodisciplinary Course	They are mandatory courses characterised by theoretical content communicated through lectures and verified throughout the year with written and oral tests.
12	Optional Course	They are elective monodisciplinary courses or, in a few cases, integrated courses that the students choose according to topics of their interest.
3	Other	Other optional short educational programs open to students at any programme level (i.e., Bachelor and Master)

The second section of the survey, the context of the teaching practice, shows that most of the practices described have been experimented with within different types of courses among those offered by the School of Design (see Tab. 2). Most of the described practices have been implemented in Design Studio or Workshops (n=24) while the remaining are distributed over the other types of courses (n=29). Another emerging result comprises the distribution of the collected teaching practices according to the existing study programmes (see Tab. 3). A first analysis shows that

Table 3. The distribution of the collected experimental teaching practices concerning specific degree programs.

N. practices	Programme level	Programme name
17	Bachelor	Communication Design
14	Bachelor	Fashion Design
22	Bachelor	Interior Design
17	Bachelor	Product Design
8	Master	Communication Design
4	Master	Design & Engineering
8	Master	Design for the Fashion System
6	Master	Digital and Interaction Design
6	Master	Integrated Product Design
8	Master	Interior and Spatial Design
9	Master	Product Service System Design

the majority of the practices have been implemented in courses offered at the bachelor's degree level (n=34), a minority developed at the master's degree level (n=16), and a small portion (n=3) in courses opened to both levels. Given this proportion between courses of different levels, the distribution of practices concerning specific degree programs appears proportionate (see Tab. 3). It is worth mentioning that often, especially the optional courses, are opened to students from different programmes.

4.2 Themes Emerging from the Rationales' Description

The rationales of the experimental teaching practices written by participants were systematically analysed and categorised from the recurrences in the responses (e.g., change in learning, number of course enrollees). Some themes emerged as recurrent through coding. Among the reasons that led teachers to experiment with new teaching practices is often related to the awareness of a change in learning, which motivates the use of more participative teaching and learning methodologies.

Try to create an amplified relationship between the teaching team and the class to foster a virtuous acceleration in the learning process and the acquisition of design methodologies [Participant 26].

Most of the respondents experiment with new practices to stimulate student participation, keeping them at the centre of the learning process, seeking feedback from them and creating enriching moments of exchange and debate among peers and with the teaching staff. This theme emerged when facing project challenges in the design studios and within theoretical single-subject courses. Many teachers experiment with new practices to foster students' development of new competencies, interdisciplinary or multidisciplinary skills, critical thinking and other soft skills to better prepare them for the professional world.

To offer students the opportunity to be prepared professionals, including on legal issues: to put together legally sound projects, to avoid litigation for them and their clients, and to prevent harassment by "stronger" companies or contracting parties [Participant 30].

Some teachers experiment with new techniques to meet logistical-organisational needs, such as few hours of lessons, inadequate tools, and numerous classes.

During the pandemic, it was necessary to include online revisions and other distant activities, which proved enriching for instructional activities [Participant 27].

Lastly, while responding to the challenges of the pandemic, teachers have become acquainted with employing blended tools, which are nevertheless considered suitable for solving practical-organisational issues, as in the words of Participant 27.

4.3 Teaching Practices Components' Emergence and Relationship from Coding

The analysis of the data (i.e., texts) related to the descriptions of practices through hybrid coding revealed i) the occurrences of the various components and ii) their correlations in terms of co-occurrence in the coded portions of text.

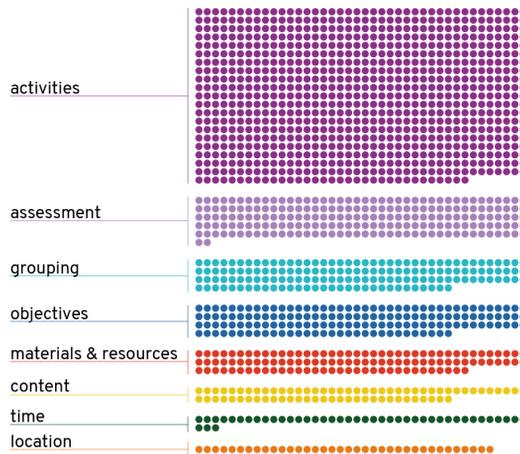


Fig. 2. Visualisation of the distribution of the components-related codes over the coded text

The analysis of the emergence of the codes (i) disclosed a polarisation of narratives in terms of modified components in experimental practices. Indeed, based on the coding, the descriptions of the experimental practices widely focused on the description of the activities that, in the teachers' written accounts, emerge as crucial components of change. The visualisation of the distribution of the components-related codes over the coded text obtained through the coding software (see Fig. 2) shows the preponderance of the code 'ACTIVITIES' compared with the codes related to the other components. Albeit in a minor magnitude, other recurrent teaching practices' components emerging from the written accounts are the assessment, the grouping, the objectives, the materials and resources. However, the remaining components, namely content, time and location, were identified in a minor way. The query formulation may have partially influenced the result, which does not portray an anomaly related to the reference context. Nevertheless, it confirms on the part of the teachers a predisposition to experimentation through practices, even when the rationales concern aspects to assessment to participation or learning per se.

The other relevant result of the coding is the co-occurrence of codes (ii), which made the correlations between the teaching practices' components emerge. The emerging relationships between codes have been visualised from the software used for the analysis in the form of a network (see Fig. 3). The visualisation is aimed at building a parallel with the spiderweb metaphor to represent the interrelation between the components (see Fig. 1). Activities emerge as a central node of the network, coherently with their relevance in interpreting teachers' accounts. Indeed the code related to this component co-occurs more than two times with all the others, as represented visually by the rods connecting nodes (see Fig. 3). For instance, the following text portion has been codified simultaneously using the codes 'ACTIVITIES' and 'GROUPING':

Students cooperate in presenting a case study in a peer discussion [Participant 43].

This practice could be interpreted in a twofold way: teachers aiming to change *with whom* students learn (i.e., grouping see Tab. 1), but at the same time also

correspond to a willingness to change *how* students learn (i.e., activities, see Tab. 1). In the visualisation (Fig. 3), this means adding a unit to the count of both nodes (i.e., ‘GROUPING’ and ‘ASSESSMENT’) and also to the rod connecting them (the grey line between the two nodes).

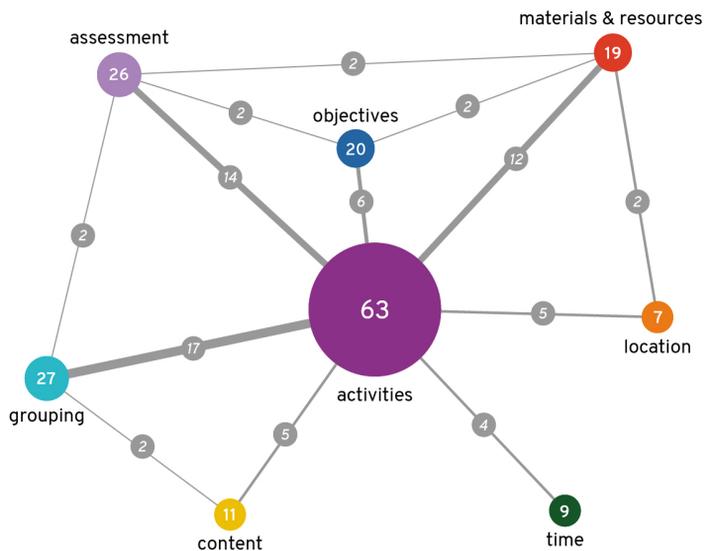


Fig. 3. The visualisation of the components’ emergence and their relationship through coding. Each node dimension is proportionate to the number of times the code has been used. The co-occurrence of code in the same text portion is visually represented by the rods connecting the nodes: the thicker the rod, the more the two codes at its ends overlap in the same portions of text. Both data are also numerically represented by numbers on the nodes and rods.

Similarly, also the following excerpt has been coded using the labels ‘GROUPING’ and ‘ASSESSMENT’:

Interactive symposia are introduced by a lecture on a specific innovation topic. Students cooperate in the presentation of a case study in a peer discussion mechanism. The exam consists of a paper on the chosen topic within one of the symposia [Participant 43].

Specifically, the co-occurrence of the code ‘ACTIVITIES’ was primarily registered with the codes ‘GROUPING’ (n=17), ‘ASSESSMENT’ (n=14), ‘MATERIALS AND RESOURCES’ (n=12) and in a minor magnitude with the remaining codes. Excluding the code ‘ACTIVITIES’, it can be noted that the remaining codes are co-occurring with some other codes, making the relationship between components in the emerging spiderweb. For instance, some code ‘ASSESSMENT’ is connected with several others, as in the case of the following excerpt:

A web application that allows managing revisions through a predefined number of appointments has been implemented. The application allows assigning a grade to both exercises done in class and group project revisions [Participant 11].

In this case, both codes 'MATERIALS AND RESOURCES' and 'ASSESSMENT' have been assigned to the text portion, as it describes the implemented changes regarding tools used to support learning and evaluation. Therefore, following the example, introducing a specific digital resource for students (e.g., a web application) also allowed teachers to change how students were assessed (e.g., the application allows assigning grades). The least connected code is 'TIME', which does not co-occur with any other beyond the 'ACTIVITIES' one.

Two examples of compelling storytelling of different but complementary practices are here fully reported to give the reader a glimpse into the responses received in the survey. The first case is that of a teaching practice tested in a theoretical course done by a non-designer to bring students closer to a hostile subject (e.g., law) through exercises that are more congenial and familiar to them.

"Through the inclusion of (optional) "practical exercises," I allow them to design something "legally sound" and "clever/understandable" to avoid running into specific problems that - in professional life - I see are the subject of most lawsuits. The results are surprising: students (by design, in a way that is certainly more immediate than those in law school) not only understand even the most obscure legal concepts with great ease, but they know how to make the most of them by giving original application demonstrations that will certainly hold up in litigation! [Participant 30]."

The second example is the "Parlament Game" developed, reported by a design teacher, and delivered to students in their first year of Bachelor's.

"There are four types of parliaments in the world, which can be classified according to how the parliamentary benches are arranged: classroom, opposing chairs, hemicycle, circular. The exercise allows students to experience the courtroom, using only chairs, the type of space where parliamentary debate takes place and understand how the environment arrangement affects the interaction between speakers. A week before, students are organized into four groups, and each chooses a text (on design) to comment on. The other groups read it and prepared remarks and counter-deductions. On the day of the exercise, the first group arranges all the chairs in the room according to the first configuration, the speaker takes the floor and makes his or her case. Three (or more) speakers from the other groups speak. The faculty performs the task of chairing the assembly by giving the floor to each speaker. The exercise continues with the second group with a different distribution of chairs and so on until the four configurations are exhausted. Afterwards, the students write a report on the experience that is commented on the next lab day. This simple exercise does not require specific equipment; the chairs alone take centre stage and allow students to understand the importance of the relationship between body, furniture and space. In addition, by choosing a text on the design, the exercise also allows students to reflect on typical practices of our discipline [Participant 45]."

The relevance of the practice resides in the willingness to introduce an interactive activity where novice students experience their leadership and pro-activity using the room's space. In the words of the teacher, this practice might be relevant in other contexts and courses because it requires elementary elements (i.e., chairs disposition), but also for conveying contents related to design as well as civic education,

4.4 Components Relevance Resulting from the Self-Assessment

Given the researchers' interpretation through qualitative coding, the result of the lecturers' assessment of relevant components of their experimental practice is

presented below (see Fig. 4). As mentioned, participants were asked to grade each component considering its relevance in the experimental teaching practice (as shown in Tab. 1).

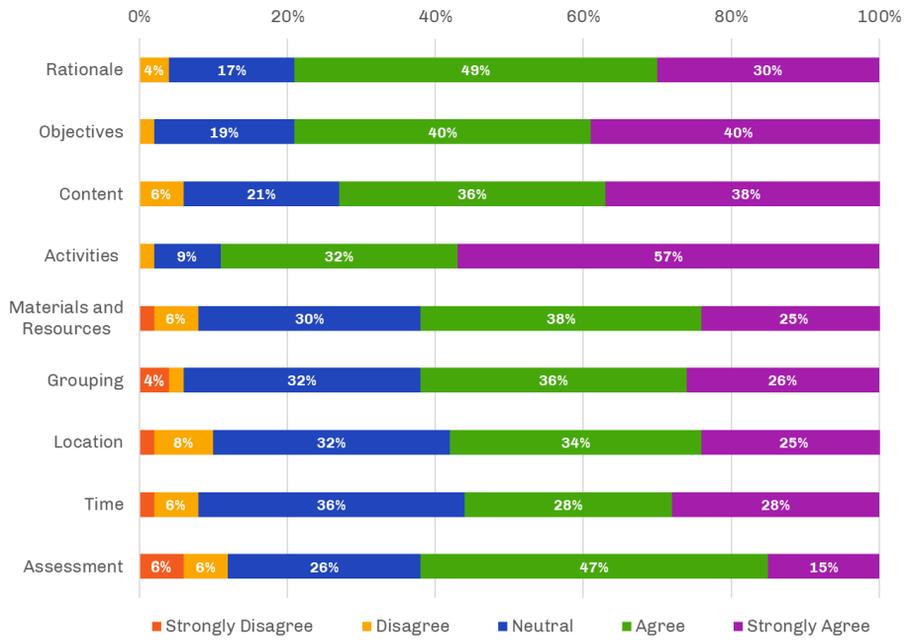


Fig. 4. Self-assessment results related to the question “*relevant components of change in the described experimental practice*”.

From the results, we can deduce that most lecturers consider the activities relevant in their experimentation (i.e., 57% strongly agreed and 32% agreed), which is coherent with what emerged from the qualitative analysis through coding. From the self-assessment, it emerges that teachers perceived to have changed most of the components in the teaching practices since all the components registered more than 50% agree or strongly agree as an answer. This result is aligned with the theory that all the components of teaching practices are interconnected [17]. Besides, experimental teaching practices’ descriptions do not disclose how some components have been modified. The qualitative coding of the descriptions showed that changes in the practice components of time, contents, and location had been little explained.

5 Discussion

The results’ interpretation led the research team to identify findings concerning the initial research questions, briefly discussed in the paragraph. Firstly, about 10% of the people were sent to participate by completing the survey and providing information regarding their experimental teaching practices. In addition, the sample collected appears to represent both the teaching staff’s roles and the distribution across degree

programs and the two levels of education (i.e., bachelor's and master's). Most practices described have been experimented with within design studios or workshops.

Rationales for experimenting with teaching practices. Several elements emerged concerning the rationales that prompted design educators to experiment with and implement new teaching practices in the situated context. The data analysis showed that many teachers are aware of the evolution of the conception of learning and are changing their practices accordingly to foster more interactive learning centred on students. This finding shows a certain degree of alignment with the guidelines for teaching innovation coming from the institution. Moreover, some experimental practices to foster active learning were implemented in Design Studios, despite the already constructive nature of the project-based approach. More expectedly, this motivation to experiment with new teaching practices has also been recorded in theoretical courses (i.e., monodisciplinary, integrated and optional courses). Another emerging motivation for changing teaching practices is the need to foster the development of competencies needed in the current professional field, which is interpreted as changing the objectives towards which students learn. The update of objectives appears to be aligned with the widely acknowledged notion that learning should attempt to acquire competencies, an idea closely related to a constructivist rather than an objectivist perspective of education. Competencies can be defined as the capability to face complex demands by combining psychosocial resources (i.e., knowledge, skills and attitudes) to drive actions [39]. Moreover, transversal competences emerge as relevant from teachers' words, such as collaborative skills, interdisciplinary knowledge, and critical thinking. This aspect is also relevant as it shows that several design teachers know the importance of moving beyond discipline-specific knowledge in favour of those competences often referred to as "21st-century skills", usually described as being relevant across disciplines rather than being associated with one [40]. Lastly, another motivation that prompted the implementation of changed teaching practices concerns the need to respond to logistical and organisational issues. The fast adaptation to distance education during the pandemic emergency emerged as a crucial rationale that fostered experimentation with teaching practices. Although these experiments were dictated by the emergency condition, in hindsight, some changes have become entrenched within practices. To a certain extent, being forced to change one's teaching practices allowed one to identify the strengths and room for improvement of what was being done before. Similar findings have emerged from previous field studies in the same context [41] and provide insight into how COVID-19 has influenced teaching and learning in the situated context.

The changing components of experimental teaching practices. The significant finding is the centrality of the activities in the collected experimentations. When describing teaching practices, design teachers focused consistently on presenting how they changed students' learning. The self-assessment confirms the result, where activities emerge as the most crucial component of change in teaching practices. The interpretation of this finding is that the central role of activities reflects the strong orientation of design education towards a learning-by-doing approach, as what is being done in the classroom (i.e., the activities) characterises the learning experience more than other components. Beyond the activity component, the self-assessment and description of the practices disclosed an interrelation between different components, as represented by the spiderweb metaphor [17][18][20]. The visualisation of the components and their relationship (Fig. 3) visually recalls the

spiderweb and can be interpreted as the component spiderweb emerging from the exploratory study in the situated context. In other words, it may be interpreted as a first attempt to show how components of change in teaching practices emerge as interrelated in the context of the School of Design at Politecnico di Milano. Since some components have been very little described in teachers' accounts, the emerging spiderweb of the School of Design could be considered tentative, which might benefit from broader investigations and in-depth study of the experimental teaching practices, which will more extensively and precisely disclose the component-to-component relationship.

Supporting self-reflection and reporting of experimental teaching practices. The exploratory study helped the research group formulate a few hypotheses to orient future research to support the development of an action research culture in the context (i.e., research as an improvement paradigm proposed by Castoldi [10]). Firstly, the survey itself may be adjusted and refined to become a tool for self-reflection and reporting of experimented practices. Following Tassoe et al. classification of curricula innovation [18], this tool helps record mainly implemented innovations in the teaching practices and from the sole perspective of teachers. Future researchers might also attempt to foster teachers' reflection in light of the results obtained by students' evaluation of the practices (i.e., attained curricula innovation). Secondly, the coding revealed a tentative visualisation of the component-to-component relationship within the experimental teaching practices. The visualisation itself may become a way to foster self-reflection for design teachers. Specifically, due to the relevance of the activities in the teaching practices, the research team envisioned that this could become a starting point for reflection and reporting for teachers. Indeed, what emerges is that in the specific disciplinary context of design, "*what is being done to foster learning*" is a crucial factor in telling about the practice of teaching. Also, the other components are described little compared to the activities. Therefore, to support self-reflection and accurate reporting needed to convert actions into action research, the research team envisioned developing a visual tool to reflect starting from the activities component and explain the changes they induce in all the other components (i.e., objectives, content, materials and resources, grouping, location, time, assessment).

6 Conclusion

The article presented an exploratory study in the situated context of the School of Design at Politecnico di Milano to investigate the contextual innovations of teaching practices. The study shows that changes in how design teaching is conveyed have been implemented in the last few years. Several motivations have determined the implementation of experimental teaching practice. One of the most crucial findings concerns the importance of the activities component in describing the experimental practices. At the same time, the other components appear to be related to the activities and each other but are marginally described in the account of experimental teaching practices. Starting from this finding, the research team envisions further investigating the components' visualisation to foster teachers' reflection on their practices in a series of in-depth interviews.

Given these contextual findings, the article contributes to the debate on innovation in learning ecosystems by proposing a method (applied here in a situated context) for analysing how teaching practices are evolving. Rather than posing a comparative analysis, the proposed approach is to develop a robust qualitative inquiry to

understand how teachers narrate their actions to update their teaching practices. Analysis of the effectiveness of the practices reported by teachers or their positioning in the framework of practices proposed in other national or international contexts is beyond the scope of this research and could therefore be a limitation.

Nevertheless, the findings emerging from coding showed how the spiderweb proposed by Tassone et al. [18] might be re-configured and adapted to explore teaching practices innovation in situated contexts. Specifically, a visual tool may be developed to foster teachers' reflection on their practices. A visual tool can help design teachers in reporting their past actions, analyse current practices, and plan their possible future changes. The same visual tool, repurposed, could become an evaluation tool for and with students who participate in the experimentation of teaching practices and can thus give a cue to teachers on the effectiveness over time of the investigation.

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