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Redefining the learning experience in design education at the Slovak University of Technology in Bratislava

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Abstract:

The present paper offers the results and evaluation of quantitative research conducted during the years 2019 and 2020 among prospective graduates and alumni of the follow-up bachelor and master study programmes of Design at the Faculty of Architecture and Design of the Slovak University of Technology (FAD STU) in Bratislava, Slovakia. The presented results of the research, combined with an analysis of the local labour market data, study of literature and an evaluation of global design education trends, were used as the foundation for changes in the learning process in design education at FAD STU, first-time implemented in the existing study programmes in the academic year 2021/22. The paper aims to provide an explanation of the new approach to learning experience design within the bachelor and master study programmes as such, but mainly described on the example of Design Studio courses. At the time of publishing, the new approach was successfully implemented in one of the faculty's vertical studios – MX lab – a learning platform focused on project-based learning and cooperation with partners in the automotive industry.

Keywords:

design education, project-based learning, soft skills, design graduates, creative thinking, interdisciplinarity, learning experience design, teamwork, product design, vertical studio

INTRODUCTION

Digital and communication technologies have accelerated the flow of information and its transition to knowledge. Interaction, speed and open-source platforms that emerged with the rise of the internet, access to vast scientific data resources, or even peer learning force the world to re-evaluate and redefine not only the old conservative model of institutional education but also the meaning of the fundamental understanding of "education" and "knowledge" as such. Formal education in the field of design, due to the rapid development in the design industry, is certainly one in which academic research practices combined with the length of standard funding and publication cycles cause knowledge delays and its rapid obsolescence.

Traditionally, art and design education has inherited a strong focus on individual work and manual craftsmanship. Industrial design as a discipline has been focused on physical products ever since. That could explain why *"university industrial design programmes are usually cloistered in schools of art or architecture"* (Talbot, 2011). Today, however, industry experts state that *"designers work on organizational structure and social problems, on interaction, service, and experience design. Many problems involve complex social and political issues. As a result, designers have become applied behavioural scientists, but they are woefully undereducated for the task"* (Norman, 2010).

The complexity of societal and scientific problems requires a change in this approach. The need for both inter-personal and intra-personal qualities – soft skills – has emerged. Furthermore, interdisciplinary and transdisciplinary cooperation has been called for by the business sector and policy-makers. The importance of soft skills is increasing both globally and in design education: *"Soft skills are closely related to what is described as 21st century skills – a broad set of knowledge, skills, work habits, and personal traits that are considered highly important for success in today's world, especially in modern workplace settings."* (Seery, Canty, O'Connor, Buckley, Doyle, 2016). Soft skills have also been defined as *"a dynamic combination of cognitive and meta-cognitive skills, interpersonal, intellectual and practical skills"* (Haselberger, Oberhuemer, Perez, Cinque, Capasso, 2014). The widely used and the most cited list of soft skills both in the educational field and the labour market refers to the SCANS report (U.S. Department of Labour, 1992) and MODES final report, where Haselberger, Oberhuemer, Perez, Cinque, and Capasso (2014) identify 22 soft skills and cluster them into

three groups: personal, content-reliant or methodological, and social (Seery, Canty, O'Connor, Buckley, Doyle, 2016).

The Future of Jobs Report 2020 released by The World Economic Forum indicates that half of today's working population will be required to re-skill in a five years' time. The COVID-19 pandemic has brought double disruption of the economic impacts and the ongoing demand for automation. Critical thinking and problem-solving have occupied the leading positions on the list of soft skills of tomorrow since 2016 and are still top-ranking (Tab. 1). Furthermore, the era of repeated lockdowns has revealed the importance of skills in self-management such as active learning, resilience, stress tolerance, and flexibility (Whiting, 2020).

Tab. 1. Comparison of top skills according to the Future of Jobs Report 2020, World Economic Forum. (Source: World Economic Forum, 2020)

Top 5 skills of 2015	Top 5 skills of 2025
Complex problem-solving	Analytical thinking and innovation
Coordinating with others	Active learning and learning strategies
People management	Complex problem-solving
Critical thinking	Critical thinking and analysis
Negotiation	Creativity, originality and initiative

One of the most extensive research projects on the future of design education, conducted globally, was documented in the recently published "White Book on the Future of Design Education," edited by iF Design Foundation. The key findings published in the executive summary confirm many of the above-mentioned concerns: *"While 20th century design was primarily understood as a result, design in the 21st century is first and foremost a process. To achieve this successfully in changing teams on an intercultural and interdisciplinary basis, techniques of interpersonal communication must become a central component of design education"* (Böninger, Schmidhuber, Frenkler, 2021, p. 21).

The report further states that *"learning to store-house knowledge (...) should be replaced by project-based learning"* (p. 20), *"designers should be trained as thinkers"* (p. 73), and *"the degree course should place students in a situation where they get involved in the doing and develop their thinking through this''* (pp. 128, 129), along with the need of the students to adopt *"the self-assurance of being able to deal with each new situation"* (p. 157). Throughout the White Book, the "threat" of artificial intelligence – or more specifically the partly already ongoing automation of specialist design tasks such as styling or generation of stock imagery – is mentioned recurrently. In this perspective, experts agree on the need to prepare students *"so that they can ask the right questions,"* which *"machines will soon provide better answers to"* (Böninger, Schmidhuber, Frenkler, 2021, pp. 150, 151).

The White Book, summarised as a result of participative process involving 250 design experts from 4 continents, suggests the following definition of the design discipline and its scope*: "Design aims for specific use by human beings: the use of messages, two-dimensional media, three-dimensional artefacts, interactions, and processes. Design poses fundamental questions, takes into account the context of usage, integrates the perspective and findings of related areas (disciplines) and produces visualisations of specific solution proposals (models, prototypes) with formative tools that are both visual and verbal in nature"* (Böninger, Schmidhuber, Frenkler, 2021, p. 119). Beside the above listed insights, the editors of the White Book emphasize the need to consider regional and culturally specific differences (Böninger, Schmidhuber, Frenkler, 2021, pp. 21, 257). Except Germany, none of the former Eastern Bloc countries was involved in the research.

LOCAL RESEARCH AND LEARNINGS

Design education at the Slovak University of Technology

The evolution of design education at the Slovak University of Technology dates back to 1981 (Petránsky, 1997, pp. 12–16), when the interdisciplinary study programme "Industrial Design of Engineering Products" was introduced at the Faculty of Mechanical Engineering at the Slovak Technical University (Slovenská vysoká škola technická, abbreviated as SVŠT, renamed in 1991 to carry the current title). The first workplace dealing with industrial and product design was established at the Faculty of Architecture (FA STU) three years before the establishment of the first Department of Design – in 1987 (Department of Architectural Planning and Design). The orientation of the design studies remained highly technical – until 2007 the degree "inžinier" (abbreviated as "Ing.", analogous to Master of Science) was still used even after the transition of the study programme to FA STU, mainly because of the strong focus on the knowledge in the field of mechanical engineering encompassed in the curriculum. At the turn of the centuries, the design study programmes at the FA STU gradually reduced the share of technical courses in favour of courses with focus on the development of creative and artistic skills. This evolution led to the transition to an artistic study programme with the "magister" degree granted at the graduation (abbreviated as "Mgr. art.", analogous to MA).

Increased interest in supporting the design education at the Slovak University of Technology was recently expressed by the extension of the official title of the faculty to Faculty of Architecture and Design, accomplished during the term of dean office of prof. Ing. arch. Pavel Gregor, PhD, with official use of the name starting from September 2020 (FAD STU, 2021). The new Slovak law on quality assurance in higher education, Act No. 269/2018 Coll. (known as the Quality Act, published on 26 Sep 2018 and as effective from 1 Jan 2022) that established the Slovak Accreditation Agency for Higher Education along with a new concept of internal quality system at higher education institutions in Slovakia, provided an opportunity to question and update the existing curriculum. Prior to starting the participatory process of the actual curriculum redesign, a series of surveys had been accomplished by Zuzana Pergerová as a part of her dissertation research in 2018–2021. In order to measure and evaluate the specific needs and education objectives reflecting the employment potential of young design professionals in Slovakia, Pergerová analysed data from the Slovak labour marketplace Profesia.sk and conducted two original quantitative surveys with FAD STU alumni and prospective 2019 graduates. Details of the methodology and results of the surveys along with the data analysis can be found below.

Survey 1: Alumni 2007–2019

In May 2020, a survey was conducted among the 2007–2019 graduates of the Design study programme at the Faculty of Architecture and Design at the Slovak University of Technology in Bratislava, Slovakia. The number of addressed alumni was defined by the number of awarded Master of Arts degrees. The structured online questionnaire, available through QuestionPro.com survey software, examined the reflection of design graduates on their own educational experiences, professional motivations along with knowledge, competencies and abilities

obtained during their design studies in comparison to their following professional practice. We realise that emphasis on the personal experience and thus a subjective point of view of surveyed graduates can lead to limited research results, but the value of their feedback was significant for further re-thinking of the design curriculum. All in all, with 353 graduates addressed by email and 49 emails not being delivered, the overall survey response rate was 22%.

Among 15 mostly qualitative questions, with the main aim described above – to empathise and understand the educational needs of FAD STU students from their perspective as recent graduates and young professionals – we focused on mapping their overall experience with design studies. Particular attention was paid to hard and soft skills. The survey identified the top three skills today's recent design graduates should master in order to find a job in Slovakia or abroad – whether as a self-employed designer or an employee. Among the top three preferred hard skills, design graduates gave preference to skills in CAD software and 2D programmes (approx. 70% of respondents), knowledge of production technologies and materials available on the market (65%) and design drawing (both analog and digital; 43%). However, respondents placed much more emphasis on the lack of soft skills.

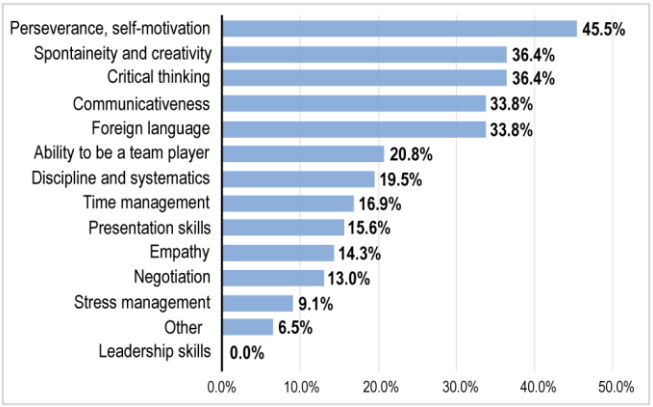

Fig. 1. Graduates' survey: What soft skills do you consider to be the top three for a young design professional? (Author: Pergerová, 2021)

As shown in detail in Fig. 1, among the top three soft skills graduates ranked perseverance and self-motivation (approx. 45% of respondents) first. They consider both spontaneity and creativity and critical thinking to be the second most important (36%), and the third place is shared equally by communicativeness and foreign language (approx. 34%). Under the option "Other" graduates stated intellect and originality, humility, business and marketing skills, networking and persuasion. Respondents further explained their experience in open-ended questions related to their struggles in the first years of practice. The insights were collected to understand deeper views, comments and feelings of students, revealing lack of soft skills cultivation during their studies. The feedback was gathered based on questions with open answers. A selection of answers below covers students' opinions on what was the most difficult thing after graduating in the first years of practice:

"For me it was definitely assertiveness at some point: to stand behind my own opinions and designs. Many companies accept young designers but offer terribly low salaries. It is often impossible to earn a living. We often do work that we do not enjoy. I think it would have helped me to gain more knowledge about how to start and run a business during my studies." (Anonymous respondent)

"Practically from the very beginning, I had to learn how to present myself better, how to work in a team and effectively manage other professions." (Anonymous respondent)

"It was hard for me to work 10 hours a day sitting and constantly bringing creative concepts. You need to be able to systematically plan your creative work so that you can tell the client the delivery date of the proposal. And, of course, the criticism. The designer receives criticism from everywhere. You need to be able to deal with it." (Anonymous respondent)

The questionnaire included, inter alia, questions concerning graduates' experience and recommendations for improving the design studies at the Faculty of Architecture and Design of the Slovak University of Technology in Bratislava, Slovakia. More than 50% of the respondents suggested broadening and expanding courses with professional soft skills. Knowledge of materials, surfaces and production technologies is constantly evolving, which is the reason the graduates suggested gaining more personal knowledge and skills (learning by doing). When being asked about suggested changes in design education, several answers were related to soft skills:

"It would have helped if I had had a lecturer who would help me find and develop what I was good at." (Anonymous respondent)

"Teaching with positive motivation rather than criticism." (Anonymous respondent)

"In creative subjects, I think it would help to support the design process, not just the orientation towards the result." (Anonymous respondent)

"There was a lack of teaching soft skills, advice on how not to burn out at work. I would appreciate if the teachers had led us more to teamwork, as well as personal time-management and systematic work." (Anonymous respondent)

Respondents also recommended to implement more interdisciplinary collaborations with other faculties, more projects with companies, to encourage more informal conversations between classmates and teachers from different areas to enrich the creative work.

Survey 2: Classes of 2019

Additional survey was conducted among students in their final years (4th and 6th year) of design studies in the bachelor and master study programme. The survey was conducted in 2019 during the submission period of the bachelor and master degree projects. The students were asked to subjectively rate their level of selected hard or soft skills on a scale from 1 to 10 (highest level) and then reflect on their educational experience in those categories in which they consider themselves to be less skilled (less than 5). In an open-ended question, they were asked to suggest some improvements to the educational process they wish to implement to achieve better personal results.

Although the methodology was different from the previously described alumni research, it led to comparable outcomes and recommendations. Students asked for more extracurricular workshops, competitions and internships. On the other hand, they self-reflexively declared that they are weak in time management and therefore are rarely able to participate in design contests. They named the need to focus on improving presentation skills, encouraging foreign language interaction, developing design thinking and including more lectures on design philosophy to support argumentation about the meaning and purpose

of creative concepts and the impact of design in society. Students also suggested focusing on practising professional communication in order to advocate for their creative concepts and learning how to make quick decisions in a dynamic world, followed by more opportunities to experience teamwork. Nevertheless, they felt strong (more than 8) in creativity and innovation, problem-solving, visual communication and considered themselves highly skilled in CAD software and prototyping.

Learnings from Profesia.sk dataset: Facts from the largest Slovak labour marketplace for the years 2008–2018

The data regarding the future of design education and the inevitable need to support soft skills cultivation not only in the Slovak labour market have been complemented with the statistics of Profesia.sk, the biggest job portal in Slovakia with overlaps to V4, as it expanded to Hungary (2006) and the Czech Republic (2007). For the purpose of our research, in Q1/2019, we asked them to provide us data concerning the development of job offers for designers over the last 10 years (2008–2018). The provided data enabled us not only to infer the development of the amount of design-related job offers, but also a list of required applicant's knowledge and skills.

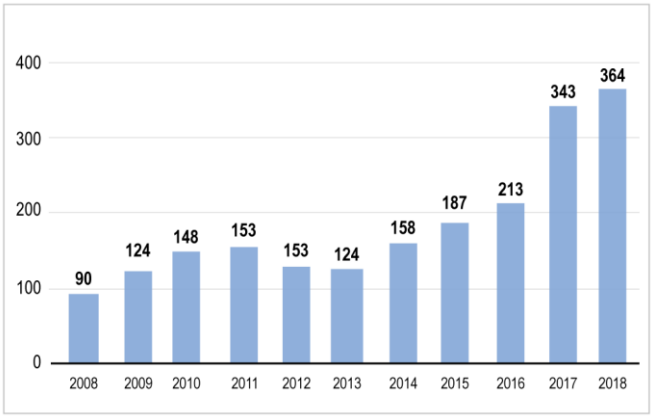

Fig. 2. In 10 years, job offers for designers have quadrupled. Number of job offers available for a "designer" (in general) 2008–2018 at Profesia.sk. (Author: Pergerová, 2021)

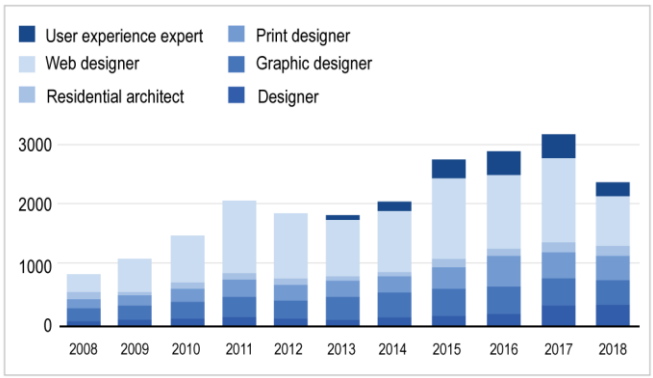

Fig. 3. Development of the number of job offers in specific design positions 2008–2018. (Author: Pergerová, 2021)

Despite the fact that between 2008 and 2018, the position of a "designer" was still mainly hard-skill oriented, the advertised positions increasingly demanded good communication skills, independence and responsibility, as well as analytical or logical thinking or resistance to stress from applicants. This could be due to the fact that product or interior designers in Slovakia mostly start their own business and tend to work alone or in small teams, without the need to hire staff, while the majority of positions at Profesia.sk is advertised mostly by small and medium enterprises that can afford to hire specifically focused workers – drawers of technical documentation, 3D modellers, web designers or often DTP or graphic designers (Fig. 2, 3).

CURRICULUM REDESIGN PROCESS

The key outcome of the above-described research for the redefinition of the study programmes at FAD STU was a matrix of the target competencies, shown in Fig. 4. The matrix introduced 3 foundational competencies (for the sake of easier communication within working groups labelled in a simplified way as "thinking", "aesthetics", "making"), and 3 advanced competencies (labelled as "interdisciplinary", "professional" and "digital" competencies). The aim of the matrix was to illustrate the hierarchy of the competencies and the logic behind the distribution of their training across the study years (Fig. 5). To explain the matrix in more details, the meaning of the simplified labels of the target competencies was as follows:

THINKING – foundational competency – the ability to independently use the methodology of the design process in favour of creativity and innovation, familiarity with the tools and methods of design thinking, the ability of critical reflection,

AESTHETICS – foundational competency – the ability to use the tools of fine arts in favour of communicating own ideas, practical knowledge of visual communication skills,

MAKING – foundational competency – the ability to create tangible representations of ideas, such as models or prototypes, practical knowledge of materials and production and prototyping technologies, including the awareness of product life cycle and its environmental impacts,

DIGITAL – advanced competency – the ability to use software tools beyond the basic computer literacy, the use of 2D and 3D digital technologies for representation and production of one's ideas, the ability to use the digital tools for creative expression or for creating own design process or methodology,

PROFESSIONAL – advanced competency – the umbrella term of "professional competencies" was created to compound the set of competencies necessary to adapt in the changing workspace of the future (communication and interpersonal skills, presentation skills, project management and teamwork) as well as to include the need to gain experience from connection to the industry as early as during the study years,

INTERDISCIPLINARY – advanced competency – the umbrella term of "interdisciplinary competencies" places a roof on specialized knowledge of humanities, social and technical sciences, necessary for a holistic approach to product development, differing based on the chosen specialisation of the individual student.

The difference between "foundational" and "advanced" competencies was mainly in the obligation and voluntariness of their adoption. While foundational competencies were all defined as obligatory, the advanced competencies were defined as subject to each student's choice and individual specialization. The necessary part of the advanced competencies was obligatory, but the extent to which the student was interested in mastering them was a matter of individual decision.

Within the bachelor and master study programmes of design, the whole curriculum redefinition process took the form of a series of participatory sessions within six working groups, coordinated by Michala Lipková and Zuzana Pergerová. The coor-

dinators designed six working groups according to the outcomes of the research, considering the key target competencies of future designers as well as the core focus of the then existing courses. Every working group was supervised by one of the five expert guarantors of the affected study programmes, who were at the same time appointed as responsible for the administration of the final definition of the bachelor and master study programmes:

1. Working group Design Studio Courses (supervised by professor Veronika Kotradyová) – the "THINKING" and "professional" competencies,

2. Working group Art Disciplines (supervised by associate professor Milan Lukáč) – the "AESTHETICS" competency,

3. Working group Workshops and materials (supervised by associate professor Peter Daniel) – the "MAKING" competency,

4. Working group Humanities & Social Sciences (supervised by associate professor Branislav Jelenčík) – the "INTERDISCIPLINARY" competency,

5. Working group Technical Sciences (supervised by associate professor Branislav Jelenčík) – the "INTERDISCIPLINARY" competency,

6. Working group Digital skills (supervised by associate professor Martin Uhrík) – the "DIGITAL" competency.

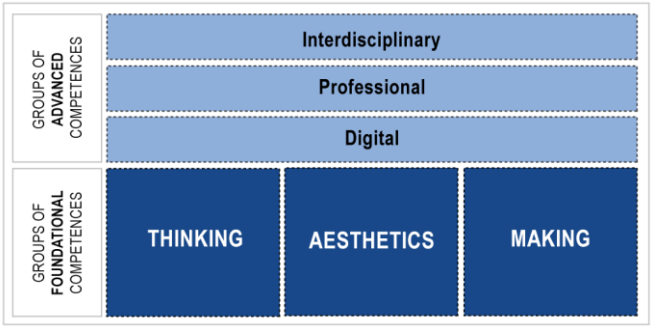

Fig. 4. Target competencies matrix for the design study programme. (Author: Lipková, 2021)

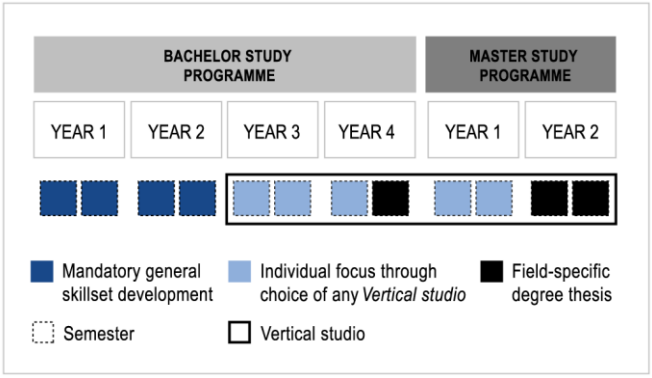

Fig. 5. Distribution of the target competencies training across the bachelor and master study programmes. The icons on the right-hand side represent possible individual specialisations of the students through the development of the unique set of competencies – illustrated on examples of interior design, automotive design or experience design. (Author: Lipková, 2021)

Over the course of 3 months from March to May 2021, the working groups were regularly meeting in an online setting (due to pandemic restrictions). The goal of the sessions, facilitated by Michala Lipková and Zuzana Pergerová, was to reconsider the existing study programme structure, discuss and agree on possible adjustments to meaningfully distribute the target competencies across the bachelor and master study programmes. The process resulted in significant changes in the bachelor and master study programmes which were implemented and became active from September 2021/22 and are still in operation at the time of publishing of this paper.

PILLARS OF THE NEW APPROACH

Based on the surveys, literature research and discussions in the working groups, the ambition of redefining the learning experience in the bachelor and master study programmes was not only to modify the formal structure of the obligatory and elective courses, but also their actual content, used learning formats and the teaching approach. Besides integrating previously discussed focus on the development of soft skills and a client-oriented approach through practice-based collaborations within the project-based learning in the Design Studio courses that will be described in detail later, the "philosophical" layer of the new approach suggested the following three new approaches to design education:

1. the idea of nonlinear learning;

2. the concept of the student as the critical agent in the learning process; and

3. the emerging new roles of the design tutor, closely related to the innovation of the regular teaching formats (e. g. lecture, seminar).

The selected strategies, which are described in detail below, were selected firstly because of their resonance within the working group discussions, secondly because of their presence in the contemporary international discourse and lastly because of their claimed ability to cultivate the skills, confirmed as lacking in the curriculum by the previously described surveys carried out by Zuzana Pergerová.

Pillar 1: Nonlinear learning

Nonlinear learning is not a new educational concept. To feature two examples of this approach, both of which arose at the turn of the centuries, the concepts of rhizomatic learning and connectivism will be compared. The metaphor of rhizome is derived from the eponymous designation in botany, where rhizome is defined as a set of horizontal underground stems (or roots) of a plant, capable of producing shoots and new plant root systems (Britannica, 2018). It does not consist of units; it is defined by direction and range. The concept of rhizome questions the hierarchical arrangement and binary understanding, it represents a plurality of ways in which an idea or solution approaches a certain problem. As a philosophical concept, Deleuze and Guattari understand rhizome as a plurality without beginning and end, without logical structure and rules (Deleuze, Guattari, 1980).

In the same way as in rhizomatic learning, the pedagogical model of connectivism, introduced in the first decade of the 21st century in the texts of Siemens and Downes, seeks a closer understanding of learning in the digital age, integrating principles related to theories of chaos, networks or self-organization. Connectivism sees knowledge as a network and learning as a process of pattern recognition. Siemens emphasizes the attention that connectivism pays to the impact of technology on our lifestyles, communication and subsequently on our learning (Siemens, 2005). In his very first article on connectivism, Downes

has used the term "connective knowledge", which, according to him, arises from the public participation of a number of actors, as exemplified by the open encyclopaedia Wikipedia. Downes defines four characteristics of educational networks: diversity of opinions, independence of individual members, their mutual interaction and openness of the whole system (Downes, 2005).

Pillar 2: The student as a critical agent

The concept of the student as a critical agent in the learning process reacts to the question of values and ethics. The concept of critical pedagogy, pioneered by Brazilian author Freire in 1970 with his book Pedagogy of the oppressed, criticized mechanical processing of „inserted knowledge" and „automated knowledge transfer", emphasizing the need for students to be conscious actors in their own development (Freire, 1970). Similarly, the aim of the emancipation method in design education is to activate students' ability to acquire knowledge and learn independently, to ask students questions and to challenge them (Černe Oven, Predan, 2015). Through their work, product designers actively respond to the social context, whether it is the choice of material, the chosen technology or the method of production of the proposed object, etc. Taking into account that few of these aspects can be taken out of the wider social, economic or political context, the application of dialogical and emancipation methods, typical for critical pedagogy, can be considered as an essential part of design education.

Pillar 3: New roles of the design tutor

The proposition of the new roles of the design tutor suggests that being an expert designer is no longer the most important role of the tutor in the position of leading project-based design education. As the previously described surveys and literature research confirmed, artistic and technical expertise as the sole focus of higher design education alone is not adequate anymore. While the position of industry expertise and the sharing of professional experience undoubtedly provide an important added value to the educational process, product design curriculum – and the Design Studio courses especially – is expected to provide a broader range of skills.

To provide relevant training for the expected set of target competencies (Fig. 4), the approach to leading the design process needs to diversify accordingly, whether by retraining the existing staff, or more realistically, by involving a range of different experts through so-called "team teaching". According to Roth, this is a standard requirement for each course at Stanford's d.school and supports multidisciplinarity, richer student experience, and diversity of opinions (Roth, 2015, p. 150). The personal coaching or mentoring, the curation of information sources (Černý, 2019), the facilitation of the design process (Manzini, 2015), or complete co-creation (Jansen, Pieters, 2017) need to be emphasized among skills required to be provided by the design tutor in the 21st century design education.

IMPLEMENTATION OF NEW LEARNING EXPERIENCE

While the change of the formal structure is easy to claim and document, the implementation of the new teaching and learning approaches, which are directly dependent on both tutors and students, is a much greater, long-term challenge that needs to be evaluated in a qualitative way after a sufficient period of time. Implementation of the revised study programmes started in the academic year 2021/22, only entering a second academic year in operation at the time of publishing of this article. Since we consider this timeframe to be too short to fully evaluate the impact of the changes, the following sections will focus on describing three examples of implementation of the curriculum adjustments, that illustrate the most significant changes in the new learning experience:

1. adjustments to the foundational Design Studio courses in the first two years of the bachelor study programme;

2. the methodology implemented in MX lab, one of the faculty's vertical studios;

3. and the concept of the newly created Design Studio Seminar courses.

Lastly, the final section of the paper will discuss the challenges that emerged along with these interventions and will suggest steps that need to be taken to fully enable the implementation of the new learning experience concept.

Foundational Design Studio Courses

The learning experience within the first and the second year of the bachelor study programme of design at the FAD STU was designed to place emphasis on acquiring the foundational skills (Fig. 4) of THINKING, AESTHETICS and MAKING, as described in the previous sections. The new content and structure of courses focused on basic knowledge of materials, production technologies, and the use of software tools was rearranged to better support the first four Design Studio courses I-IV, which students take as a whole group under the supervision of a stable teaching team.

Complimentary team teaching in the first two years has been specifically assigned to develop critical thinking. Strong focus on hard skills, being naturally cultivated right from the beginning of the studies, has been complemented by a second lecturer. The teaching tandem shows the students how diverse approaches supplement each other, broaden horizons and that different opinions force us to argue correctly, objectively, and pragmatically. Students experience various statements and learn to analyse, evaluate, and interpret arguments and take responsibility for their decisions.

Vertical studio example: MX lab

After the first four terms, the students at FAD enter the so-called vertical studio. The concept of the vertical studio is based on a cross-class teaching approach of the key Design Studio courses, where students of the 3rd and 4th class of the bachelor programme study together in one group with the 1st and the 2nd year students of the master degree programme. Students can choose from a variety of studios and are able to change them every term. Since the offer of the places in each studio is limited, students get the chance to experience the competition when applying, in a way similar to the job market.

Vertical studios can be again team-taught, by the group setup they naturally promote peer learning, teamwork and, above all, project-based learning. Among the suggested didactic concepts, the earlier mentioned White Book on the Future of Design Education lists the teaching format of a laboratory: *"focus on very limited content that has to be explored in more depth on a step-by-step, practice-oriented basis; the experimental side of this format liens in addressing themes that are new or on the periphery of the curriculum so that their sustainability for the course programme can be tested initially"* (Böninger, Schmidhuber, Frenkler, 2021, p. 160).

In this fashion, the MX lab vertical studio, with the abbreviation referring to "multidisciplinary research" and "experience design", was founded to create a platform for experimenting with

the emerging tools of digital design, dematerialized design processes and intangible forms of design in the field of automotive interior design as well as mobility in a wider sense. In addition to providing a hands-on experience with emerging technologies, the laboratory explores objectification of the design process. The lab maintains a vivid contact with the automotive industry and the project-based learning in all classes derives from industry assignments.

During the term, students solve open-ended tasks, carry out user research and consult their findings and next steps directly with industry experts. The curricula are not directed by predefined inputs from the expert but are rather co-created in real time by the contributions of those participating in the learning process – the community shapes the curriculum of the educational process in the same way that the rhizome responds by adapting its structure to the stimuli of the external environment (Cormier, 2008). In this sense, the fluid "rules" of rhizomatic learning, without a fixed beginning and end, allow the student to become the driving force of the learning process.

By providing the opportunity for promotion or internship placements at industry partners, the lab helps the students develop their strengths, identify the weaknesses and understand their role in the wide spectrum of design specialisations, directly in real life confrontation with labour market demand. The lab works with strong emphasis on self-management and development. One of the methods to help students shape one's professional programme is a systemic goal setting (e. g. through the Design Compass tool, see Lipková, 2021, p. 35) and reflection within course evaluation (1:1 mentoring with the tutor). Students are asked to take control of their professional lives by their personal assignment modifications, goal setting, improvement suggestions. Roth, one of the d.school founders, describes the method of achieving the habit of results delivery (Roth, 2015, p. 150). The hidden message of this approach is the necessity to take personal responsibility for one's own success.

Design Studio seminars

The concept of the Design Studio seminars was present in the design studies at the FAD STU well before the implementation of the adjustments. The change that was introduced was an increased consistency throughout the studies – in the updated programme, every Design Studio class has a collateral seminar that provides supporting methodology; and increased alignment within the content delivered in the seminars with respect to the focus of the collateral Design Studio courses in the same class. Seminars provide methodical support of all Design Studio courses, with increased intensity in the first two years, when the Design Studio courses focus on developing creativity and critical thinking (1st year), and feasibility within limited material groups such as plastics and metals (2nd year). In the years that are devoted to participation in the vertical studio, which provides the students with the space for individual development, the seminars focus on deepening the professional competencies, such as design research, teamwork and academic writing. The seminars aim to create an atmosphere of mutual peer-support, courtesy and favour.

CONCLUSION

The contemporary models of higher education still carry a strong legacy of the linear approach, headed towards a fixed destination. The goal of design education in the bachelor and master study programmes in the field of Design should be to acquire a set of competencies and skills needed by the industry, whether from the perspective of an employee or a freelance designer. As argued earlier in the text, these core competencies are no longer possible to be defined as a constant, but rather as moving targets in an uncertain future (Böninger, Schmidhuber, Frenkler, 2021, p. 118). Designer's skills need to be expanded to include the skills of the 21st century which, according to the conducted surveys and gathered quantitative data, are identified as essential soft skills, self-management, complex problem-solving, teamwork, and critical thinking. By claiming this, the authors do not neglect hard and technical skills, but call for an equilibrium and enriching one's professional competencies with cognitive and personal capabilities that are gaining importance in the era of automation and digitalization towards Industry 4.0. After implementing the described adjustments in the study programmes in the academic year 2021/22, the following challenges were collected based on the direct experience of both course tutors and students:

Nonlinear learning requires the shift to more interactive, participatory and flexible learning formats, ones that encourage individual definition of personalized learning goals, along with peer knowledge exchange, curation and verification of information sources, and one that supports student's future ability of autonomous learning. This shift raises a need for agile and interactive learning platforms, their effective moderation and technical maintenance. Student as a critical agent calls for increased emphasis on supporting student's individual critical approach to a wide spectrum of topics in a contemporary social, environmental and political context, through building the culture of dialogic discussion in all courses with an interactive teaching format. New roles of the design tutor can only be enabled by diversifying the personal structure of the institutions of higher education, including hiring experts with professional profiles beyond the traditional academic experience. The above listed challenges suggest that a full implementation of the new approach to design education at the FAD STU still requires – alongside the still needed updates in the content of the courses – indeed the systemic changes at several organisational levels of the institution as such. With the gradual progress of these changes, the authors plan to collect regular feedback from all involved parties for future reflection and evaluation.

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