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SUCCESSFUL COLLABORATION BETWEEN DISCIPLINES IN A VIRTUAL TEACHING CONTEXT THROUGH THE APPLICATION OF DESIGN THINKING

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ABSTRACT

The curriculum in the "Engineering Design (Interior and Furniture Design)" Bachelor program has frequently changed over the years regarding how and what kind of study modules are taught. In the 2020-2021 academic year, the teaching staff was presented with another novelty – the transition to full-time virtual training in practical design and purely artistic disciplines.

In the context of introducing a new virtual education modality, the new teachers in the department decided to leverage the moment and test innovative ways of working that are widely applicable in their practices and were formerly introduced in their design training in foreign universities. Their approach was based on integrating *design thinking* with the traditional approach used in the program to bridge two separate study modules from the curriculum – "Graphic Design" and "Furniture Design for Public Spaces". In the process, the assistant professors introduced a few new tools, principles, and perspectives, all with the idea of raising the level of engagement and practical fieldwork experience among students, taking advantage of the positive aspects of working in a virtual environment.

Key words: design thinking, virtual ways of working in the design process, motivation, collaboration between disciplines, interdisciplinary training.

INTRODUCTION

The SARS-CoV-2 pandemic, which swept the world in 2020, posed serious challenges to the course of economic development, daily life, habits, and behaviours of people worldwide. The anti-epidemic measures imposed mandatory distancing, which created a series of obstacles for the routine tasks of every employee in every field of activity. The COVID-19 pandemic affected every aspect of higher education, not only the approach to teaching and learning but also how higher education institutions (HEIs) are managed or administered. It was necessary to create a new mode of teaching that would ensure stability and consistency in the educational system and mitigate the negative impact of mass closures on the learning process (UNESCO, 2022). According to an international survey conducted by the International Association of Universities (IAU) in May 2020, about 67% of HEIs switched to virtual learning, about a quarter temporarily suspended education while seeking solutions to the situation, and 7% wholly discontinued teaching the subjects for the academic year (Marinoni et al., 2020).

Both globally and in Bulgaria, HEIs had to find an individual path towards optimal development of their educational and managerial processes. Within this challenge, the teachers from the Department of Interior and Furniture Design at the Faculty of Forestry Industry at the University of Forestry also took steps towards implementing innovations for distance learning for their students.

EXPOSITION

Two new lecturers – Maya Ivanova and Samuil Botev, were included in the teaching team as assistant professors for third-year students majoring in "Engineering Design (Interior and Furniture Design)". They were assigned to continue the collaboration initiated more than five years ago between the two disciplines, namely "Graphic Design" (GD) and "Furniture Design for Public Spaces" (FDPS), focusing on project integration. Their new challenge was to conduct activities with students in an entirely virtual environment, leveraging the technological solutions provided by the university for remote work.

Drawing on their professional perspective as service designers, Maya Ivanova and Samuil Botev analysed the existing training program and its implementation, focusing on the students' experience. They identified areas for improvement and devised an action plan. Based on their professional expertise and design education abroad, they proposed a strategy aiming at enhancing the students' motivation through the facilitation of activities integrating the knowledge of both disciplines.

As a foundation for planning the work process, the assistant professors implemented elements of the *design thinking* approach as the primary methodology. In this specific case, all participants in the process had to be guided remotely using digital products for virtual collaboration. Crucial to the success of implementing the methodology was creating the right conditions, namely a virtual collaborative environment that met several essential requirements. Like the walls of a classroom, the virtual environment needed to present the work of all students simultaneously, document their progress, store their work, and serve as a platform for communication between students and their teachers. Using such software products was a familiar practice for both assistant professors from their work with teams abroad. The assistant professors proposed using the Mural platform, in conjunction with the digital tools already established at the university – Microsoft Teams for video meetings and Microsoft Office software products for document creation and execution of current administrative tasks.

The primary reason for implementing an interactive platform was to create a more motivating process, which the teachers supported by integrating techniques from the increasingly popular gamification trend. The process of incorporating gaming elements and techniques into non-gaming contexts helps increase participant's motivation, giving them greater freedom and confidence to utilise their potential to a greater extent (economic.bg, 2020). Drawing on elements of gamification throughout the process, Mural facilitated collaboration between students and teachers in various ways beyond those initially planned for FDPS and GD: creating an open-access interactive digital semester plan, conducting activities to explore students' needs, capturing and documenting feedback during presentations, and creating a better overall experience and new educational value during individual mentoring sessions.

One of the significant contributions that the design thinking methodology brought was the introduction of field studies on existing architectural sites and spaces and their users by the students – a step that is foundational for the methodology. Despite the situation of remote learning and strict epidemiological measures, students had the opportunity to visit and observe the real interaction between people and the environment in the spaces they were to design. The results of the field study were analysed using a "Concept Poster" – a tool created by the assistant professors – to summarise the findings to date and set the main challenge for resolution in the subsequent phases of the design process.

Viewing the entire teaching process as a service that they could optimise, the assistant professors decided to improve the processes of delivering their ongoing, midterm and final assignments and presenting them to the rest of the students in a way that would create more value for all participants in the process. Throughout the semester, the assistant professors invited various volunteers to engage in managerial activities, coordinate assignment submissions, prepare virtual galleries, and expand their organisational skills. From a technological implementation perspective, virtual exhibition halls were created again in Mural, where volunteers published all students' projects at the end of each main phase of the design process and planned class presentations (*conferences*).

The format of sharing work during the *conferences* also transformed the perspective of assistant professors. They introduced a new presentation element – the *elevator pitch* format known in the professional design industry, which requires composing and presenting a short story reflecting the core value of the idea or project within 3 minutes. During group presentations, students were invited to assess their peers and share their opinions on their work, further enhancing their competence in critical thinking and giving feedback.

Last but not least, the teachers took advantage of the opportunity to invite guest lecturers from the industry to show students the possibilities of working with design thinking, FDPS, and GD in the private and public sectors, making a connection between the knowledge taught in the academic environment and what is at stake in real business settings.

METHODOLOGY AND PRINCIPLES OF WORK INTEGRATING DESIGN THINKING INTO THE FDPS + GD PROCESS

One of the factors that profoundly influence the development of the educational system is the dynamics of the global socio-economic environment. Its variability requires continuous implementation of new methodologies aimed at developing new qualities in students, commensurate with the demands of the job market and necessary to cope with the challenges of the changing professional environment. Among the most cited qualities of modern professionals are the development of creative thinking, teamwork skills, critical thinking, and the ability to tackle complex problems. The global educational community has experience with various approaches aimed at developing these skills, but the design thinking methodology stands out from the rest with unmatched success (Pereira and Russo, 2018).

The design thinking methodology (DT) first appeared in the literature through the work of Nobel laureate Herbert Simon (Guaman-Quintanilla et al., 2018) in 1969. Still, it became popular in an educational context only in the new millennium with the introduction of the eponymous educational program at Stanford University in California (Brown, 2008). According to a literature review by Pereira and Russo (2018), DT is most commonly applied in education in management and management sciences, engineering, design, and multidisciplinary disciplines in HEIs. Through their analysis of the most critical characteristics of DT, the authors confirm why this methodology is so widely popular in the field of engineering education worldwide.

Alongside the need to study and utilise available resources and opportunities, DT leads students to a process of constant shifting focus between free creative thinking and precise decision-making, requires experimentation and improvement based on achieved results, and, last but not least – encourages the development of empathy in students – a manifestation of

understanding and connection with the needs of the users they design for, as well as a manifestation of the same understanding towards their teammates (Pereira and Russo, 2018).

According to another study by Guaman-Quintanilla and colleagues (2018), HEIs acknowledge the beneficial influence of the design thinking methodology primarily in creating a safe space where students develop and test knowledge and skills outside their direct educational field – the focus of the discipline itself. The specific qualities that the authors point out as being developed in participants in the learning process through the application of the methodology are precisely teamwork skills, the development of creative thinking, problem-solving skills, and the manifestation of empathy (Guaman-Quintanilla et al., 2018).

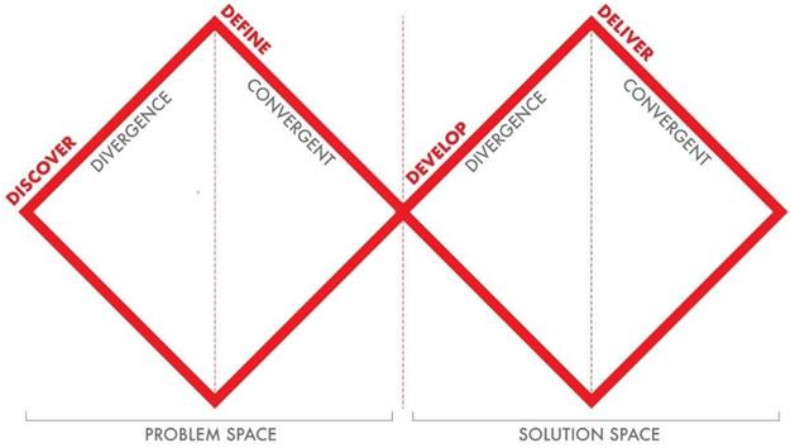

Figure 1: The framework encoding the design thinking process – The Double Diamond, 2005. (www.DesignCouncil.co.uk).

During the preparation of the semester curriculum, assistant professors Maya Ivanova and Samuil Botev, together with associate professors Desislava Angelova and Pavlina Vodenova, adopted the Design Thinking Methodology (DTM) as the guiding methodology (fig.1). The aim was to integrate essential elements of the methodology as the main line of the educational process. This updated integrated program continues the existing tradition of the work process integration between the two study modules, "Furniture Design for Public Spaces" (FDPS) and Graphic Design (GD). Drawing on their experience from design education abroad, the assistant professors aimed to build a bridge between the two study modules, enabling students to seek common ground in both design processes, to develop a new way of thinking based on research logic, to explore interconnections, and frequently to switch focus between details and the big picture. The teaching approach involved individual work and presentations in three subgroups, totalling 36 students.

The specific steps taken by the new assistants, together with the lead instructors of the FDPS and GD disciplines, in developing the semester plan for the new program were as follows:

1. Analysis of the existing curriculum and the specific tasks that are a mandatory part of the practical training in the FDPS and GD study modules.
2. Familiarisation with the tools, platforms, and teaching structures used in the education of third-year students in Engineering Design in the considered study modules.

3. Development of a plan for integrating assignments from both modules based on elements of the 4 phases of DTM from the "Double Diamond" framework – Discover, Define, Develop, Deliver.
4. Integration of new methods and principles from the DTM practice to enrich the approach to work and develop students' skills to focus on the needs of the end-users.
5. Integration of new tools and a new virtual working environment that encourages collaborative work and feedback exchange.
6. Creation of new structures for organizing the workflow, including the voluntary involvement of students in managerial responsibilities.

Based on the described steps, the instructors created an updated plan for project-relatedness between the FDPS and GD study modules based on the individual phases of the DT methodology. In the FDPS study module, students were tasked with designing public spaces and the necessary furnishings to meet the needs of a specific user experience. Each student worked on an individual assignment representing an existing public facility with various functions – commercial, administrative, service-oriented, etc. Those students with similar or analogous assignments were invited to work in teams and share experiences and knowledge while studying and analysing user experiences.

In the GD study module, students were tasked with working on the graphical representation of the service, the interactions of which are situated in public buildings, to develop the graphical elements that support the furnishing of the building and the positive experience of the users within it. With the help of the project-relatedness strategy and DTM, students had the opportunity to understand in-depth the relationship between the decisions that guide their individual design practice and to create a design project that demonstrates an understanding of the interaction processes and user experiences in a service-oriented building "end to end". The distribution of specific tasks that the students had to prepare and execute during the semester in both disciplines is presented in Figure 2.

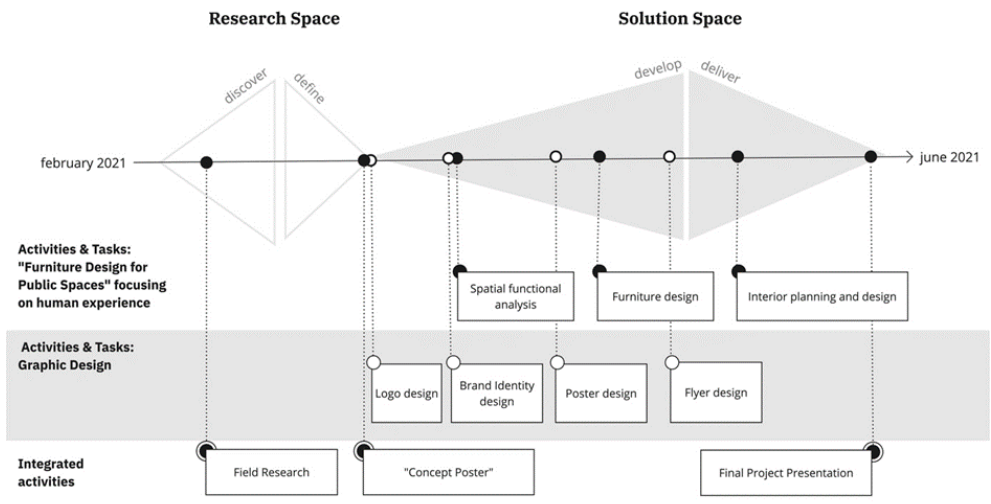

Figure 2: Main tasks and activities during the integrated semester project work based on the design thinking methodology (author graph).

In addition to the purely technical intervention regarding implementing elements of the Design Thinking Methodology (DTM) in practice and enhancing the experiences of students in remote learning, the assistant professors also relied on several guiding principles to direct students throughout the work process. These principles aim to facilitate discussions during design classes and support understanding the different steps in the DTM-based work process.

The first principle emphasised the importance of user research, particularly field research, as a fundamental missing step in the existing curriculum, which should inform the design process for furnishing public spaces. Field research offers researchers the opportunity to gain knowledge about the actual situation they are studying, the authentic human behaviour, the processes, and the artefacts that influence it. Various field research methods used in the design practice provide direct insight into everyday life and provide detailed and highly specific information about the actual situation to a degree of effectiveness that no other method could achieve. With the knowledge gained from field research in the Discover phase, designers gain numerous insights and make more informed decisions in the subsequent stages of concept creation and design. For this reason, the assistant professors introduced students to field research tools as the first task of the design process in the integrated curriculum, namely contextual interview approaches and participant observation.

In the DTM process, embedding the designer in the design context is of paramount importance, as this situation focuses their attention on the user and the environment in which they are placed. This process, in turn, leads to insights into their authentic needs and problems and the creation of truly innovative ideas for their solution. Field research is crucial in developing the sense of designer of empathy, and through emotion and logic from their experiences in the contextual situation, they gain insights, inspiration, and intuition, which help them reach more informed decisions. From this perspective, during the process of designing a public interior, students were supposed to learn how to investigate and analyse authentic user needs and use the results in the concept development phase.

As public spaces provide specific services (commerce, transportation, administrative services, etc.) and serve a specific group of users, studying the user experience in the space is crucial in designing functional layouts and furnishing. It is essential to examine how to create simple and inspiring experiences that meet the needs of users, their purpose of visit, expectations, and even their easy navigation in the interior. As part of the FDPS study module, students were supposed to learn how to design a public space to meet the needs of its main users – employees and service providers, visitors, customers, citizens, etc. The analysis of users and the concept of their experience were included in the Define phase of the DTM process, with the development and presentation of a new tool based on tasks from both disciplines – the Concept Poster.

The third fundamental principle embraced in the integrated teaching approach was related to exploring the connection between graphic identity and the space itself and its users. In the Development phase of the DTM process, students were expected to apply their integrated concept related to user needs in practice and, based on it, design the interior of the facility and the visual identity of the brand providing the services used. Creating a comprehensive artistic project for designing every element of the furnishing, including graphic elements and materials, was intended to follow the presented design direction from the Conceptual Poster.

As a new addition and fourth principle of the integrated program training, continuous mutual feedback and assessment by students in their smaller groups were emphasised. The assistant professors created a virtual gallery for the students to publish and mutually evaluate their

projects to stimulate activity during the activities and develop critical design thinking. Feedback, one of the most essential components for the successful flow of the design process in the DT methodology, allows students to develop their critical thinking and express their opinions freely in front of an audience. In order to stimulate the iterative process of project improvement, the feedback-giving structure required the expression of a critical viewpoint rather than evaluation, as it is believed that assessments often lead to a reversal of the motivating effect and even lower the quality of the learning process.

Of utmost importance for increasing student motivation, which was one of the main goals of the integrated program, was the encounter with successful examples from practice in the form of guest lecturers. During the FDPS and GD design classes, assistant professors allowed students to meet successful professionals in the field who could share examples from their long-standing practice in Bulgaria and worldwide. Using guest lecturers as a teaching method is a successful strategy that enriches the student's experience with the subject matter. According to Butler and Wielligh (2012), multiple studies prove the advantages of inviting guest lecturers, including creating a link between theory and practice and providing networking opportunities during education.

KEY INNOVATIONS IN THE EDUCATIONAL PROCESS: DESIGN AND VIRTUAL COLLABORATION

The shift to remote learning during the 2020-2021 academic year was pivotal in shaping the updated curriculum for FDPS + GD, with virtual workflows offering more opportunities for creative interventions, sometimes without the need for additional financial resources. However, remote learning brings its own risks, and the success of the integrated program relies heavily on the organisation of the work process, tools, and the environment for interaction among participants. Studies conducted by Garrison and Cleveland-Innes (2005) revealed that students who exhibit positive attitudes and interactions with instructors and peers demonstrate higher academic performance than their peers lacking such engagement. Further research indicates that, particularly in the context of virtual learning environments, increased interaction with the course content, active participation, and engagement in providing feedback contribute to the quality of acquired knowledge.

To enhance student motivation in an unconventional manner for the department, assistant professors decided to employ techniques from their professional sphere. A pivotal role was played by introducing a new workspace environment that would activate motivation and allow for more active interaction. This included increased flexibility during work, easy feedback expression, the creation of entirely virtual individual and team workspaces, and easy organisation and management of the work process. To provide these opportunities in a fully virtual environment, assistants introduced a new tool – an online interactive whiteboard, Mural – which catalysed this innovative approach to work. An additional advantage of using such a tool was achieving transparency in the educational process with all students. Since all spaces in the platform used were openly accessible, each student enrolled in the course not only had the opportunity but was also encouraged to review the progress and work of their peers. The platform was provided free of charge by the supplier company upon application by the young instructors.

The use of the virtual workspace platform not only facilitated a more interactive and dynamic process of sharing results at the end of each phase but also during the development of

assignments themselves. By incorporating elements from the increasingly popular gamification process applied in an educational context, instructors managed to transform students' routine design classes into motivating activities. For example, in the FDPS study module, Mural was used to organise one-to-one consultations in a manner that added additional value to students' experience. The assistant professors were tasked with preparing a virtual hall with a visual analogy of a "cinema" with tables for consumption, where students had the right to reserve a seat for a specific hour they wanted to be consulted. While some students conversed with the assistant professors, others could wait and watch educational and inspiring video materials on topics discussed during the design classes. Gamification is increasingly applicable and used to increase the motivation and engagement of employees in a work context. It provides an opportunity to turn everyday routine work tasks into a fun activity – two concepts that are generally perceived as oxymorons. Of course, the difference between a game and a work process is clearly distinguishable due to their fundamental purposes. While games provide pure entertainment, the goal of gamification in the work process is to bring motivated desires for specific beneficial actions.

The implementation of the specialised Mural platform, besides offering more interaction opportunities, also brought new requirements for students, such as a new system for submitting assignments and documenting their individual work processes in the virtual space. To ensure the successful completion of this mandatory step for students, the assistant professors proposed additional solutions for improving organisation. Semester planning was done using an open visual map with a schedule of all vital assignment submission dates, and to ensure the successful execution of each step, a volunteer structure for administering individual subgroups was implemented. In this way, more active students were engaged in a new managerial role, which contributed to developing their proactive and organisational skills at work. The responsibilities of volunteers distributed in the individual subgroups were limited to creating a virtual gallery to present each student's creative tasks and collecting and publishing the respective tasks before the day of their group presentation. The role of volunteers was not static for the entire semester but distributed across a more significant number of students who exchanged responsibilities during the process, providing an opportunity for anyone willing to contribute to the flow of activities and further develop their leadership skills.

The specific steps followed in organising the work process with volunteers were as follows:

1. At the beginning of the semester, the assistant professors organised a collective activity where all interested students could sign up as volunteers to manage the process – called Mural Angels.
2. At the start of each new phase, assistant professors announced the next volunteer in line – a total of three, one for each subgroup.
3. Each volunteer received additional privileges for using the online platform Mural.
4. Each volunteer was tasked with creating a virtual gallery for presenting completed tasks for the specific phase.
5. Students submitted their assignments to the volunteer electronically.
6. The volunteer organised the virtual gallery with the submitted tasks.
7. During presentations, everyone worked with the prepared virtual gallery in a common room in Mural.

8. After successfully completing the phase, assistant professors interviewed the volunteers to obtain feedback and understand the challenges in the process.
9. Volunteers rotated with other students for the next phase if they expressed willingness to do so.

In addition to the innovative work processes during the design classes, assistant professors aimed to support the professional development of students, especially their presentation and communication skills. Each student was invited to present the progress in their development at different stages in the format of an elevator pitch, commonly required in specialised investment programs and widely used not only in the business world but also in education. The term elevator pitch, with which this method is popularised, indicates its importance – a brief 30-second presentation (literally – the time of one elevator ride) in which the speaker should demonstrate the value of their proposal. This type of strategy is also suitable for high school students who are preparing for work or applying to universities. It allows the application of not only communication skills but also allows the students to be self-confident in their strengths and potential (Ivanov, 2019). After listening to the presentations, students were tasked with providing evaluations and sharing feedback on why the presented ideas contribute value to the development of their colleagues from the conceptual phase.

The final innovation in the practice of guiding the educational process in the study program was providing the opportunity for feedback to the assistant professors and overall process management. The survey questions quantitatively and qualitatively examined interventions in the first part of the educational process, where most of the changes were observed compared to the previous organisation of the semester plan – the introduction of the field study phase. With the help of a virtual survey form, assistants were able to determine if the applied methods and tools were truly delivered in an easily digestible manner and which parts of the process could still be improved in the next stage of conducting such an integrated program.

CONCLUSIONS

Upon completion of the integrated educational process FDPS and GD, observations by the teachers leading in the study modules indicate a high level of success in terms of student activity and their ability to embrace innovation. The motivation of the learners in an entirely virtual environment was consistently assessed as high throughout the work, and engagement towards delivering the final results of each phase of the design projects was satisfactory.

Data from the survey after the completion of the first phase confirms observations of the assistant professors – 64.3% of respondents did not encounter any difficulties in completing any of the tasks. Additionally, 92% of those who faced challenges responded positively that the assistance during the class activities was sufficient to overcome the difficulties.

Observations also indicate that field studies of the real needs of users, which are the focus of the Design Thinking methodology, help build a genuinely informed concept for development in the design phases. The critical viewpoint of students and their progress in gradually mastering specific design thinking was demonstrated in the subsequent stages of interior design and brand identity design. Although a new method of work and challenging in nature, field studies provided students clarity on the questions "What is needed?" and "Why is it needed?" to be designed right from the start of the design process.

Additionally, the tool for field study analysis tested with students in the first phase of the project – the Concept Poster – was successfully implemented in the FDPS discipline and in the following course of instruction, as well as in the Residential Interior Design and Furnishing (RIDF) study module in the academic year 2021–2022.

The unconventional and innovative approach of the assistant professors spurred the more diligent and ambitious students to develop a wide range of additional qualities, while the opportunity to work in an open virtual space allowed them to showcase constantly their progress to their peers and set the bar for individual groups. On the other hand, presenting ideas and engaging in shared discussions also contributed to the engagement of most students to put more effort into participating and developing their projects to receive valuable advice and feedback.

CONCLUSION AND DIRECTIONS FOR FURTHER RESEARCH

The hypothesis of the assistant professors that integrating the Design Thinking methodology would provide more opportunities for developing the professional skills of students was met with various positive observations on their part. Design Thinking not only provides practical guidance for working on a specific assignment by leading the process to a simple solution to systemic problems but also encourages the expression of critical feedback, making multiple decisions, and providing argumentation. Specific new methods, such as field studies and the Conceptual Poster, were met with interest by the students and had a beneficial impact in the subsequent design phases.

Providing the right working environment that satisfies the requirements of the Design Thinking methodology also proved to be crucial for the success of the current initiative. The process of working with the chosen digital platform for virtual collaboration gave students more freedom and responsibility in their personal workflow, particularly in working with volunteers and teamwork assistant professors used various gamification elements in organising the process with the help of the virtual platform to increase students' engagement and confidence during the work process and to loosen direct teacher control in some management aspects of the educational process.

As an analysis of the conducted study and compiled observations by the teaching team can attest, not only did the new teaching methods increase student engagement, but the innovations in the teaching approach itself led to their fruitful experience.

In conclusion, it would be appropriate to investigate the implementation of the entire Design Thinking process in the work of students during the FDPS+GD process. Since the current initiative was based on an approved curriculum, it was impossible to integrate all elements of the methodology fully. Despite the successful implementation of field studies, which represents a novelty for the curriculum, physical time constraints hindered the addition of additional elements. It would be beneficial to make changes to the current curriculum to successfully go through all the elements of Design Thinking, including prototyping and prototype testing (Deliver phase, Fig.1). It is these last two elements that are often crucial for the success of a project and show how well the designer's solutions up to that point have truly been tailored to the needs of the user and the environment for which they are designing.

Additionally, an innovation could be the use of a virtual whiteboard like Mural, which would provide a more dynamic workflow, easier feedback, a more engaging presentation, and a review of work by both students and their instructors.

As a research method, a more comprehensive and detailed study could be conducted on the degree of student engagement and motivation, as well as their ability to understand the taught material in an accessible way, which is one of the main challenges of virtual work.

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