

An International Student Workshop on Design Thinking in Time of Corona:

Redesigning an international event as an online interactive learning experience

Abstract

The purpose of this article is to report and describe an online workshop in design thinking. This workshop, which is part of the European Erasmus+ project *DT.Uni - Design Thinking Approach for an Interdisciplinary University*, should originally have taken place in Lublin, Poland but had to be moved online due to the pandemic situation. The participants were undergraduate and graduate students from seven European universities. They were selected through local universities' design thinking bootcamps. In the online workshop, multidisciplinary teams of 3 to 4 students, organized across the countries, engaged in (re)framing a complex problem. The traditionally face to face design thinking group assignments were redesigned to be executed by online synchronous collaborating teams using tools such as Zoom and Miro. All teams were supervised and supported by at least one facilitator. The participating students were very positive about their knowledge gain in problem solving and a design thinking approach and they appreciated working with the chosen online tools. The online workshop showed many benefits of online synchronous and asynchronous collaborative learning but could not sufficiently substitute the social component of a face to face event, in particular beyond the scheduled workshop hours and the interconnectedness that a face to face event could have in the context of the local social environment.

Keywords: Design Thinking, Online Learning, Collaborative Tools, Higher Education

Introduction

The overall objective of the Erasmus+ project *DT.Uni - Design Thinking Approach for an Interdisciplinary University* is to enhance the level of interdisciplinary thinking at Higher Education Institutions (HEIs) by using a bottom-up approach that supports all stakeholders (students, researchers/academics and management/administrative staff) in developing their ability to think divergently, creatively and in a designerly way (cf. <https://www.umcs.pl/en/dtuni.htm>). Altogether, this study involved HEI students, researchers

and administrative staff from eight European countries, the Netherlands, Portugal, Italy, Slovakia, Germany, Iceland, the UK, and Poland.

The present analysis corresponds to the digital replacement of the DT.Uni event originally planned as a four-day event at UMCS - the Uniwersytet Marii Curie-Skłodowskiej - in Lublin, Poland, 20-24 April 2020. Instead, due to the novel Coronavirus crisis, the *DT.Uni International Design Thinking Bootcamp* was organized online from 5-7 May 2020. This Erasmus+ partnership event, with the lead for the design and development by the University of Amsterdam (UvA), was promoted with partners Guarda Polytechnic Institute (IPG), *Technische Universität* Dresden, Birmingham City University, University of Economics in Bratislava, Sapienza University Rome, Bifröst University, and University Marie Curie-Skłodowskiej (UMCS - the project coordinator).

From a quality assurance (QA) perspective, this case study aims to determine the applicability and appropriateness of this type of alternative for similar events. The reflection will consider whether the carefully planned redesign of the offline to online event can in fact create the desired effect and/or whether the change, in connection with the uncertainty of the times, leaves a gap in fulfilling the expectations of both organizers and participants. The novelty of this situation is the abrupt need to find alternatives to working in person, which merits an analysis of the planning and conducting of a Design Thinking (DT) workshop online for HEI.

1. Background

The online context of the workshop warrants a brief incursion into the foundational research of online work and blended learning and its applicability to DT. Almost 50 years ago, Jack Nilles, Director for Interdisciplinary Research at the University of Southern California (USC) first proposed *tele-work* and *tele-commuting* as a solution to the traffic problem in Los Angeles since “[t]elecommunications technologies are becoming ubiquitous and powerful” (Nilles et al., 1976, p. 1). Despite a widespread embrace of remote work for its offer of greater structured intentionality and clarity (Newport, 2020), as recently as 2013, there have been official decisions to return to the office, as per one CEO’s memo claiming, “We need to be one Yahoo!, and that starts with physically being together” (Mayer, in Newport, 2020).

However, in 2012, the year that was marked as the Year of the MOOC (Massive Open Online Courses), doubts still remain about how to plan a successful online course. Engagement is the rule of thumb, in direct contrast to the potential for that elusive missing piece: motivation (cf.

Guthrie, 2003). Some recognized strategies for engagement include, among others, active learning, interactive content, educative assessment, the use of small groups, and keeping it simple. These dynamic approaches are encompassed within the active application of a combination of facilitating the *seven ways of learning* (Davis and Arend, 2013), the *backwards design process* (Wiggins and McTighe, 2005), and the interdependent *taxonomy of significant learning outcomes* (Fink, 2003), all somewhat derived from New Bloom's hierarchical *taxonomy of educational objectives* (Anderson and Krathwohl, 2000; Krathwohl et al., 1973; Harrow, 1972; Simpson, 1972; Bloom, 1956) as demonstrated in figure 1.

With an attractive assortment of visual techniques, interpersonal strategies, and content that works best when it is interactive, DT could be a challenge to adapt to an online situation. As a non-linear and iterative process, DT involves challenging assumptions so that problems can be redefined before creating innovative solutions, prototyping, and testing. Accordingly, the DT.Uni International Design Thinking Bootcamp was redesigned to be carried out online, mindful of the defining characteristics which would include a limited time for remote teams with students and facilitators, distributed across Europe. Together they would use selected collaborative platforms and tools that provided the required communication for their cooperation across formats, tools, and channels. Video and chat should provide an uncomplicated pathway across mobile devices, desktops, telephones, and/or virtual room systems. The teams would work and interact within this dynamic system that should enable collocated, distributed, and remote teams to engage intuitively in a near in-person collaboration experience with multiple options for real-time and asynchronous teamwork. The online interactive whiteboard was the chosen backdrop to produce the different techniques used during the event, which included remembering the future, framing questions, field exploration, persona, and even to some degree prototyping.

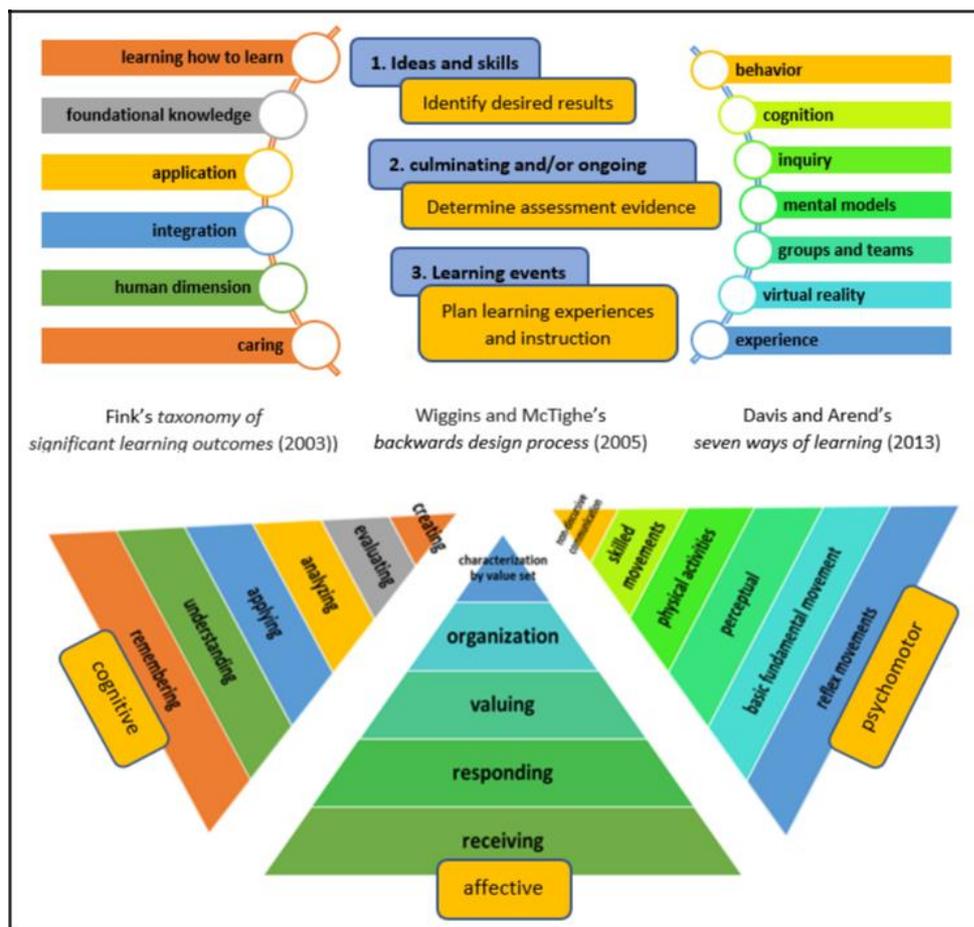


Figure 1 - The influence of New Bloom's Taxonomy of Educational Objectives (1956/2000)

Source: Adapted from Davis and Arend (2013), Wiggins and McTighe (2005), Fink (2003), Anderson and Krathwohl, 2000, Krathwohl et al. (1973) Harrow (1972), Simpson (1972), Bloom (1956)

Notwithstanding what the authors consider to be the obvious benefits of working together physically that an Erasmus+ partnership affords to the HEIs involved, this paper finds the positive aspects in the online approach that could be leveraged in the future so that other projects may proceed with less trepidation. The online activity will be considered in areas where the objectives and the time needed to complete tasks were most affected, especially in terms of logistics, objectives, and time on task. The complexity of using digital tools and online strategies and further adapting novel strategies and management activities was carefully designed for targeted learning as well as for developing interpersonal relations.

The rest of the paper is organized as follows: Section 2 deals with the online workshop logistics and planning, as well as the contingencies of redesigning the workshop to move online. Section 3 describes the tools and strategies supporting the development of interpersonal relations

and competences in the proposed online format. Section 4 provides some highlights of the informal reflection held at the end of the last session in the online chat. Section 5 presents and analyzes the results and attempts to identify the student perspectives on the advantages and disadvantages of online versus face to face workshops. Finally, conclusions are drawn, and future work is laid out.

2. Logistics

This section offers a compilation of the changes that affected the objectives, preparation, participation, team creation and management, scheduling, and structure of the online international event.

2.1 Objectives

In comparison to the planned international event in Lublin, the online event was designed to be shorter. The adjustment in the time-frame required reconsideration of the original plan to work through all of the iterative steps of DT over the course of three days instead of the four days defined for the original event.

One of the goals of this workshop in both settings, physical and virtual (online), was for each team to develop a unique design vision or point-of-view to a wicked problem (a problem that is so complex and multifaceted that solving it is inherently difficult and cannot take place using standard strategies), and subsequently to frame it in an innovative way. The partners agreed that a novel focus would be to develop the DT empathy phase rather than to simply shorten the time spent on each original activity.

Development of the DT competences requires time. The customary way of solving complex problems is jumping very fast to an idea or pre-solution, where the biggest challenge actually is in discovering what the problem is. Note that, when tackling wicked problems, manifestations of the real problems could be interpreted as the problem itself, which would be counterproductive to the discovery of innovative solutions.

To assure the necessary time for experiencing the DT phases, the online workshop was split in two sessions with one day in between that was meant for the asynchronous individual/group learning and research work. This split construct was also chosen as a result of good experiences with this course design in the workshop Design Thinking for university

management staff at the University of Amsterdam (Faculty of Science). This approach of focusing on problem discovery aligns to the work of Dorst (2015), who in *Frame Creation: Create new thinking by design* convincingly shows that the pivotal activity in design consists not in coming up with all sorts of (wild) ideas but in framing the problem. In order to do this, a deep understanding of the problem should be developed, and considerable attention should be paid to ‘understanding the problem space’. Only when such a deep understanding of the problem has taken place can a valuable frame to the problem emerge, making this Empathy phase, as well as the Defining phase, the crucial aspects of a design thinking process.

With this in mind, the workshop aimed to convey to students the proper mindset for dealing with complex challenges and overcoming all sorts of almost natural tendencies to ‘tame’ wicked problems. The biggest impediments to good design are the convictions that you know what the problem is like (bias), that it is like similar problems you have dealt with earlier, and that you therefore can use similar strategies to solve them. Complex challenges defy these assumptions, as they are novel and unique, and therefore require their own unique approach.

Achieving this appropriate mindset in students to approach wicked problems was one of the major goals of the international design thinking workshop for students. When circumstances changed, and in order to avoid overloading students with too many activities (as they already were having online classes at their universities due to confinement), the organizers were compelled to compress the program so that the workshop could be successfully transferred online. The decision was easily made to focus on the activities in which student teams would be deepening their understanding of the problem, and thus trying to elaborate their own vision to deal with the problem while focusing less on less-essential activities. Therefore, the focus of the workshop was on the core of DT: problem discovery, or, as some of the participating students described it afterwards, writing, “I think it is better to focus more on the question before finding a solution”, and “It is really important to take enough time to understand the problem and not to dive into idea generation too fast.”

2.2 Local bootcamps

To prepare for the international event in Lublin, all participants had previously attended a one-day local bootcamp organized at their own university campuses. The length and the design of the local bootcamps differed per university to fit the best to the local situation and the possibilities. For example, at UvA (Amsterdam, the Netherlands), a ‘pressure cooker’ design

thinking workshop of 4 hours was organized, focused on developing a new frame to a complex problem - improving the creative skills among university students. Since a valuable frame can only be developed when the underlying system and themes are understood, student teams started with exploring and understanding the (educational) system and discovering (hidden) themes causing the current situation. For example, when teams might have discovered that *time pressure* was an important theme hindering creativity, the problem could be framed as, “If the challenge of stimulating creativity amongst students is seen as resolving around the issue of time pressure, then ...” Or, to put it in the ubiquitous DT *How might we...* format, “How can we reduce time pressure in order to stimulate the creativity of students?” Having brought teams into a substantiated ideating mode, the most promising idea was prototyped and tested, with critical thinking stimulated during the whole process. At the IPG DT Beta Innovation Bootcamp (Guarda, Portugal), a 5-hour session involved all phases of design thinking. The Portuguese-speaking students used English to work in interdisciplinary teams from the study areas of Accounting, Computer Engineering, Cybersecurity, and Sports. The innovation bootcamp included the following DT tools: (i) Clarifying the challenge with storytelling and metaphors; *Persona*, User Motivation Analysis, and *How might we...?* for Exploring; (iii) Brainwriting and ranking, Sending a postcard/twitter for Creating; (iv) Pen and paper for Prototyping in 2D and in 3D; and (v) Evaluating via peer-, self-, and user-assessment. Special attention was given to the communication amongst groups so that pauses between the phases were ripe with observation and ideas were challenged giving rise to rethinking, reshaping, reformulating and reexamining their understanding throughout these iterative processes.

2.3 Organization

The DT.Uni event in Lublin was planned for 64 students and at least one professor/researcher from each of the eight project partner universities, encompassing more than 70 participants. Given the alteration of the date, approximately 50% (31) of the designated students could no longer honor their commitment to participate; in the end, another seven students had to cancel unexpectedly. With the definitive 33 student participants, nine teams of 3 to 4 students were organized to be oriented by a designated 1 or 2 facilitators from each of the eight HEIs involved. During the registration process the participants provided information on their interests and proposed challenges for the teams to work on. While the original workshop planned for Lublin had aimed to cooperate with local organizations providing the challenges, this was not feasible for the online version so the challenges and respective design briefs were formulated by the facilitators, taking into account the challenges proposed by the students.

After the interests and suggestions were analyzed and grouped into main topics by the project coordinator (UMCS), each facilitator group developed a design brief for their respective team. A design brief is a written explanation, given to the design team, that outlines a complex/wicked problem, the aims, objectives and the milestones of a design project. It was made available for the team members a day before the event. This organizational aspect did not vary much from the initial plans although the time allotted for the presentation and the Q&A was reduced. However, since the facilitators had filled out an extensive design brief in advance, teams had a good initial introduction to the content of the design challenge and an understanding of the problem they would be working on. Finally, the challenges of the small internationally-mixed teams were based on their own interests and suggestions.

2.4 Overall scheduling

A serious concern of the DT.Uni team was the digital overload for students during lockdown. The three-day workshop was organized in two online sessions with a day in between for the groups' research work. The goal was to provide the maximum activity in the minimum time so that there was not an overload in each day. The overall schedule was divided into two blocks of 3 hours each online, as follows:

- Day 1 13:30- 16:30 CET
- Day 2 Time for research
- Day 3 10:00-13:00 CET

The time for research was designed to give participants the opportunity to organize their work flexibly with their respective teams.

2.5 Structuring the 3-hour sessions

The 3-hour sessions were organized as an alternative in closely timed paired sets of central activities in the main room of the video conferencing tool followed by team activities in the online breakout rooms, where an interactive whiteboard was used that supported synchronous collaboration for each team (figs. 2a and 2b; see also Appendix 1: Detailed Schedule...).

WORKSHOP AGENDA	
Session 1 (all times are CET)	
13.00-13.10	Intro + warm-up
13.10-13.30	Brief on the design challenges
13.30-14.00	Challenging assumptions
14.00-14.30	Remember the future
14.30-14.45 Take a break	
14.45-15.15	Framing question
15.15-15.45	Field explorations
End session 1	
Session 2	
10.00-10.10	Intro
10.10-10.35	Persona
10.35-11.00	Point-of-view
11.00-11.20	Storytelling
11.20-11.35 Break and switch to plenary session	
11.40-13.00	Plenary session for final presentations
End session 2	

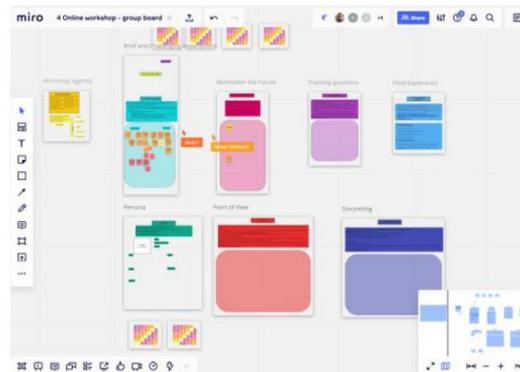


Figure 2a - Detail of the Workshop Agenda as presented on the Miro boards of all teams

Figure 2b - Interactive online whiteboard (Miro) of one of the teams during Session 1

Some of the more apparent strategies that manifested as best practices during the workshop are gathered here although others may become apparent with time:

(i) The centralized coordination of the workshop, with a dedicated breakout room controller and a plenary coordinator, guaranteed coherence throughout the event. Returning to the main session to meet with the workshop leader André Nusselder (UvA) was very intuitive and clear to all.

(ii) The convenience of the embedded links to the support documents was an organizational best practice, with the related documents stored in the drive.

(iii) The deliberate choice to keep the required contact hours low was confirmed in the informal reflection at the end of the final session; ironically, for a design thinking project, the consortium had not consulted with its users – the students – in advance to ask how long they might want to work online each day. Based on the cry for more, it might seem that the event could have been scheduled for a longer duration. Nevertheless, the showtime expression, “leave them wanting more” might apply here since the negative effects of too much time online are clear as well. Nevertheless, the overall mood was summarized by this student’s assessment, “I want to repeat this experience and to develop our ideas.”

(iv) The ability to use both plenary sessions (main room) and smaller team sessions (breakout rooms) in Zoom was a big advantage. This change of environments kept lecturing to a minimum and guaranteed a good working dynamic. It also provided hosts the flexibility to move between breakout rooms.

(v) The previous training of the facilitators who, after five weeks of planning for this alternative solution, met the week prior in an online simulation of the event to deal with any doubts in advance.

(vi) The deliberation meetings of all the facilitators 45 minutes before the start of each online session and the reflection meetings after each of the two online sessions synchronized the facilitators and provided a means for resolving problems in a timely manner. The facilitators also created an online channel (a google doc) to reach each other during the breakout sessions, which was particularly useful in the first part of the workshop to help the facilitators feel in tune with the activity and with each other.

(vii) The importance of good intercultural and communicative competences was at a premium, of course between facilitators and their teams, but certainly also amongst and on the student teams. It was remarkable to find that a significant number of students stressed the relevance of group communication and were eager to improve their proficiency in English in order to increase their international collaboration skills.

Overall, the success of this international event was predicated on clearly defining and identifying obstacles, collaborative tools, time constraints and the instructional context of Design Thinking with the respective facilitators.

3. Tools and Strategies for competence building

The analysis of the tools and strategies adopted covers the digital platform/tools and materials design to promote and support the team's online interactivity and collaboration.

3.1 The digital platform and digital tools

The workshop was given in Zoom, which was familiar to both UvA and IPG due to pandemic-inspired solutions at their respective campuses. The virtual main room (fig. 3) served to gather the 33 students and the team facilitators for lead-in explanations about each task given by the workshop leader, the final team presentations, and the final reflection.



Figure 3 - Main Zoom room during the workshop in interaction with the workshop leader (André Nusselder, bottom center)

The teams worked on the DT tasks in their respective breakout rooms using the tool Miro (<https://miro.com/>), an online collaborative whiteboard platform. Each of the nine teams had its own collaboration board on Miro, prepared in advance by the project coordinator UMCS, where the tasks and times were also reinforced. The Miro platform was available through the whole workshop, including the day between the sessions. Note also that students were free to use any other tools of their choice, some of which included SurveyMonkey, Google surveys, Google Drive, e-mail, WhatsApp, PhotoShop, and Microsoft tools such as PowerPoint.

3.2 Materials design

Each team executed eight design thinking tasks over the three-day event that concluded with a team presentation. These tasks were built on design thinking strategies and approaches selected and authored by André Nusselder (Faculty of Science, UvA). The participants received the reading material that described the DT tasks a few days before the workshop and, as intellectual output of the Erasmus+ DT.Uni project, will be made available in creative commons.

Because of the reduced time, some of the planned DT techniques were left out of the online event, notably brainstorming, prototyping, and testing *after* having reached a complete understanding and successfully defining the problem, which we consider to be the core of design thinking. For the primary purpose of developing a valuable point-of-view incorporating a design vision of the problem, the online activities focused on developing critical thinking via '*Challenging assumptions*'; creative thinking by '*Remembering the future*', understanding both the system and the user in techniques and tools like '*Field explorations*', '*Concept and*

Theme mapping', and *'Persona*', and finally defining through strategies like *'Framing questions*', *'Point-of-view*', and *'Storytelling*'.

3.3 Promoting online collaboration, critical thinking, and creativity

The students developed a broad range of competences, such as complex problem solving, adaptation to rapidly changing circumstances, critical thinking, flexibility, 'learning to learn', teamwork, and creativity. Taking just three of these developments - collaborative teamwork, critical thinking, and creativity - evidence from the workshop shows that the aspects that could be perceived as missing in an online learning environment were in fact present and dynamic in nature. The primary concerns are related to the distance raising an insurmountable barrier to the development of human contact with teachers and colleagues.

The online workshop aimed to maintain the interactive nature of a design thinking approach through a focus on eight collaborative online tasks that were directly available for each team on their own online collaborative boards, prepared in Miro before the event for the respective teams. The task templates included brief descriptions of each task to be executed so that participants could focus without the distraction of having to refer to other files or documents. In Miro, team members collaborated in this digital workspace, where each task board was filled with digital sticky notes and writing tools to create maps and diagrams to visualize complex processes and systems (see Appendix 2: Screenshot of teamwork developed on the template using Miro).

The choice of tools and platforms contributed to the collaborative efforts during the event. Note that Miro as a tool helped sustain not only the team activities during the synchronous tasks in the breakout rooms but also the asynchronous research activity for each team, with further communication made possible by WhatsApp group messaging and emails. Collaboration beyond the event also demonstrates effective synergies ignited by the event based on interpersonal relations and contact, with both teachers and colleagues. Additional activities with partner universities were scheduled and have been carried out within weeks, including guest speaking appearances during Zoom-supported class periods and extra-curricular speaking events. These partnership-based opportunities for students to get to know each other and even the colleagues who could not attend the event itself seems to speak to the crossing of borders, albeit virtually, and enriching of the intercultural spirit intended by the Erasmus+ program.

The students were also asked to practice and develop critical thinking (CT), first of all by challenging their own assumptions, the hidden and often unconscious ideas, beliefs and

convictions about how things are or should be working. Not recognizing these hidden ideas and convictions means staying in the same old (thinking) mode and may therefore be extremely obstructive to innovation. Challenging assumptions is opening up to new perspectives. During the event, students learned that making up answers is not so easy, which contributes to learning how to deal with complex problems, exemplified by one student's quote, "Trying to find an answer for a question leads to finding so many other questions." Critical thinking itself leads to a deeper understanding of the topic, which is why one of the goals of the workshop was to integrate the constructive nature of this type of thinking into the design process, as a pivotal aspect that was openly received by the students, one of whom noted, "It was very interesting to see how we had to change ideas and later came back to them with a few changes, all in all a very fluent and continuous process." At the end of the workshop (see section 4 below), the reflection also stimulated their critical thinking.

Finally, with creativity identified as a way of "defying the crowd" within a "culture of conformity" (Sternberg and Lubart, 1995), the project partners were focused on reducing perceived threats and developing safe learning environments so that participants could feel the support and let their creation work unbounded. Although "unique and unlike other scientific endeavors, [...] creativity [...] is implicitly collaborative" and "requires both originality and effectiveness" (Runco and Jaeger, 2012, p. 92), mingling "the useful with the beautiful" (Bethune, 1839, p. 61, în Măciucă et al., 2019, p. 121). Yet another feature of creativity has been postulated as *surprise* (Simonton, 2012). For example, in the workshop team dedicated to transdisciplinary education, the name Mirai (未来) was selected for the Persona for meaning *the future* in Japanese, a language nobody in the team yet speaks thus simultaneously portraying the hope and the unknown mirrored in the futures of the team members. In the Dt.Uni team dedicated to Artificial Intelligence, the group was named Full Automation, deriving from characteristics of this area.

3.4 Presenting results in a virtual environment

All teams achieved very good results and positive feedback for their team presentations. Figure 4 shows just one part of a presentation given in the final main Zoom room session, where the five-minute focus was followed by an additional 2 minutes reserved for Q&A.

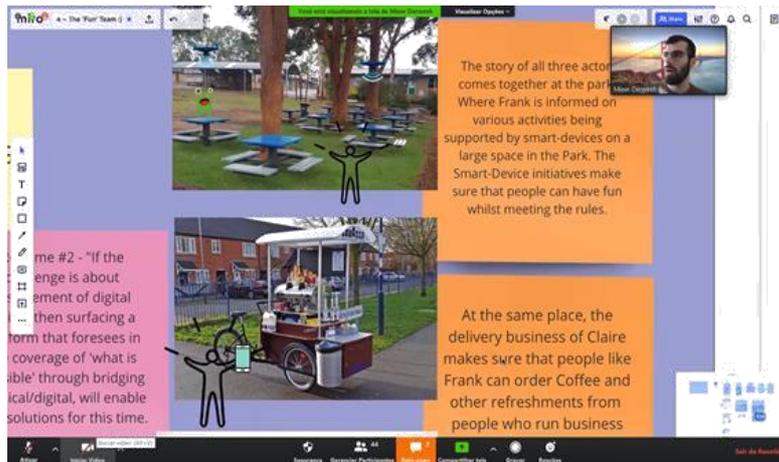


Figure 4 - Screenshot of a group presentation

The team presentations were diverse and quite fascinating, demonstrating the variety of approaches used to tackle the different problems. Student teams all developed an interesting and unusual perspective to the problem that they were faced with. Noticing these results showed clearly that the online environment allowed for creative processes to take place, that good results can also be found in a short amount of time, and that the instructions as text with good explanations allowed for a focus on problem framing.

Although students did not know each other before, the online collaboration in teams was fully achieved. The online workshop did not retain the original plan for a final competition amongst the design solutions. Looking back on this online workshop, no competition element or prize was needed to motivate the participants to fully invest their energy.

In general, the previously defined areas to explore and the time designated for each phase of the innovation bootcamp were effectively supported by the structure of the Miro boards and assorted tools and strategies used by the multidisciplinary teams during this successful three-day workshop using and developing different design thinking strategies.

4. Reflection

The last activity in the final moments was a reflection-driven chat session which provided a real-time sharing bonanza in a highly-charged atmosphere fueled by the adrenaline from intense participation and interaction (see list of reflection questions in Appendix 3).

This time dedicated to critical (self) reflection served not only evaluative purposes for the organizers to obtain feedback on the quality of the workshop but also, and above all, was meant to stimulate student learning by having them reflect on their activities during the workshop. The insistence on reflection as a mode of learning and a way of improving personal skills also provides a path for learning from personal ‘shortcomings’, an aspect of design thinking, which was reinforced throughout the workshop, with one student reporting that he or she learned to “not try to be perfect”. By means of critical reflection, students were challenged to consider what kind of skills and approaches are needed to accurately deal with complex problems, for instance, in a question like, “What did you learn on problem solving strategies and methods for dealing with complex challenges? Why did these (not) work? How did they differ from other strategies that you were already familiar with?” Design thinking, with its focus on understanding problems and concept development, can be less familiar than other innovation strategies, where, for instance, the idea need not be developed but is already there, as in the lean approach in agile methodology.

The reflection period, with the following representative sampling of the written responses in the chat, provides an opportunity to assess whether the workshop has met the objective of further developing the students' understanding of the design thinking approach. Note that, while in most responses, the language has been preserved as reported, just a few alterations have been made for communicative purposes where indicated with an asterisk.

Some sample responses to the question, “What surprised you?”, are as follows:

- *The fact that good results can also be made up in a small amount of time.*
- *I was surprised to be able to work remotely and quickly even though I know little about my 'team', thanks to being united by the same motivation*
- *The thing that surprised me the most was that we could all work in groups even though we are from different countries and speak different languages, we could work together and understand each other for a common purpose*

Another question asked, “In which situation would you want to apply things that you have learned here?”, with the following sample of responses:

- *school and work projects mostly*
- *teamwork and human relations in general*
- *idea generation in work*
- *further in my degree to better break down complex mechanics and situations to create better solutions (*)*
- *every day in different situations*

- *I would like to apply them in teaching students and making some changes in the educational system - but also in private life for coping with a lot of different problems (*)*
- *it would be useful to use this approach for all problems that will arise in the future*

5. Effect measurement and evaluation

Data was formally gathered to measure the effect of the workshop in two forms: (1) comparison of the pre- and post- test measured knowledge gain and (2) participant evaluation, with an additional five questions. The response rate for both tests was 19 out of 33 participants (58%). All responses were distributed across a Likert scale of 1 to 5, where 5 is *absolutely agree*. The participants evaluated their gains in knowledge and skills based on this workshop in three statements:

- *My specific lexicon (terminology) in design thinking has increased.* 17 participants agreed to strongly agreed and 2 participants were neutral about it, with an average rating of 4.3.
- *My ability to formulate questions in English has increased.* 17 participants agreed to strongly agreed and 2 participants were neutral about it, with an average of 4.2.
- *My ability to work in intercultural contexts has increased.* All 19 participants agreed to strongly agreed, with an average of 4.6.

All 19 participants agreed on the statements about their future plans, “I will be using more elements of Design Thinking in the future at my workplace or at university” and “I will encourage others to use Design Thinking processes in the future”, both with an average of 4.7.

After the online workshop 21 participants responded to a survey with six open questions, detailed below, about their experience. The students were very positive about the workshop and about what they had learned. Most of the participants expressed the preference for an even longer workshop.

First, the participants dealt with the open question, “After the local bootcamp and the online workshop, what would you say about design thinking as an approach to problem solving?” Their answers, classified below in three general areas of identified change, suggestions for the future, and a process-oriented approach to creativity, show that they find the design thinking approach to be very valuable for problem solving and they want to apply it. Spelling has been normalized in all responses and, as in the previous samples, for just a few responses indicated with an asterisk, the language has also been altered for clearer communication.

Changing approach to problem-solving and interdisciplinarity

- *It's a good way to see problems from more sides. (*)*
- *I really like the idea, as I am studying industrial design myself, the approach is not new to me, but using it on new topics not related to physical products is interesting.*
- *Design thinking allows you to truly solve problems by going beyond known solutions and allowing you to achieve optimal output.*
- *DT is an amazing approach to understand and solve problems.*
- *Great approach to big problems, not that good for small tasks.*
- *DT is very helpful in solving problems, we can better understand whom and what we are doing our product/service for.*
- *It's the way to go, not only for problem solving, but even to generate ideas.*
- *I think it is a perfect way to approach issues and subjects.*
- *It's a great and really fast way to solve problems, and it's nice because we have to brainstorm with our group and that makes it also funny.*

Suggestions for the general future and personal plans

- *I believe it is definitely underrated. It should be promoted more in the educational system, especially in the higher educational institutions.*
- *I love it! It is an interesting and smart approach, in step with the times. It can be applied in all fields.*
- *It would be the principle thinking in every situation.*
- *I think that it is a great way of thinking and approaching problems, I personally find it too systematic and will therefore use many elements of this process, but in my own order and on my own time.*
- *After this bootcamp, I can now say that design thinking allows me to put myself in the shoes of others and to think creatively in solving problems, mindful of the fact that I do not have to be perfect in providing suggestions. (*)*
- *It's something that I will use in further group works for sure.*

Creativity to avoid traditional pitfalls

- *Compared to traditional problem solving, design thinking is a good approach, as it allows to understand the problem clearly and include others' ideas effectively. So it has less chance to come up with a solution which is not actually required. (*)*
- *Design thinking is essentially a process that through activities such as divergent thinking, synthesis, convergence, and through the means of critical thinking and a problem-solving attitude, allows one to explore but also have the various emerging insights in confluence towards a clearer problem and therefore a better solution.*
- *I loved the way of exploring, creating, searching problem solving in a very creative way.*

In 14 responses to the open question, “What is the value of design thinking in your opinion?”, the value ascribed to design thinking can be classified in three outcomes - diverse perspectives and greater understanding, collaborative and interdisciplinary benefits, and dynamic added-value for problem solving - sustained by the following direct quotes:

Diverse perspectives and a greater understanding

- *offers different perspectives on a subject matter*
- *provides us with much deeper information*
- *focus on the user and develop a deeper understanding for their Needs*

- *opening minds and reaching interesting insights*
- *a better fitting solution to a better understood problem*
- *you get different ideas for the same problem*
- *expands consciousness*

Collaborative and interdisciplinary benefits

- *reason divergently and collaborate deeply*
- *must be done in a group and therefore encompasses the point of view of several people*
- *teamwork and organized thinking*
- *take on board the importance of interdisciplinarity and teamwork*

Dynamic added-value for problem solving

- *stop limiting ideas to fit a certain expectation*
- *great way of tackling problems*
- *solving problems in dynamic ways*

On the question, “What do you think about the time frame? Were the two three-hour-long sessions enough for this topic?”, just one felt satisfied with the given amount of time while 20 of the 21 responses indicated that they would have preferred more time for their work so that a longer workshop would be fine. One participant commented,

The time went by so fast, probably because from the moment we were allowed to step back into our 'virtual-groups', we started hitting the ground running in order to generate ideas. () And the overall process was just fun, and it got more fun as more outputs were generated and the ideas became more vivid and the uncertainty fell increasingly to the background.*

Another participant responded, “*It was the first time for everyone in this new mode, so this timeframe was good to start. Next time 2h sessions could be scheduled for several days.*”

We also asked the participants to compare online and face to face learning with the open questions, “How would you compare online and offline activities? What are the advantages and disadvantages of both?” The diverse positive aspects of they referred to about online learning, covered accessibility so that, given no constraints, more participants could join in and time saved in travel; the possibility of expedient and organized simultaneous work; the opportunity to feel less shy about speaking English; a comparative notion that using online tools is better than using paper; using the cloud to cam record conversations; and being in the comfort at their own homes. Almost all participants identified the most important disadvantage of online meetings as less social interaction. They would prefer seeing their team in person to build more intensive, personal and deeper connections.

“Online is great and accessible but it can be impersonal. This is where offline is more beneficial. However, offline can be a logistical challenge. I would have loved meeting others

in the teams in person and getting to know them. Online cannot directly facilitate this, but it is easier to work around."

"I am very sorry that this workshop was not possible in person, however I would like to thank the organizers for the effort and the wonderful experience!"

Finally, we asked the participants to evaluate their experience with the online tools with the following open questions, "What do you think about the tools we were using (Zoom and Miro)? Did you find them useful and helpful for working online? What other tools would you recommend us to use next time?" The responses showed the participants to be very positive about the tools used. They appreciated breakout rooms and the use of a split screen to work using the two tools synchronously. They very much appreciated the simultaneous work on the interactive whiteboard (<https://miro.com/>). They found the tools useful, adequate for teamwork and working with these tools intuitive. While the responses included one recommendation for Slack and another for Canva, they did not indicate that any other tools were missing to get the job done.

Conclusions and implications for further research

The *DT.Uni International Design Thinking Bootcamp* was initially designed to be organized on location, in Lublin, but this was not possible because of the Coronavirus pandemic. As a contingency plan, the DT.Uni team succeeded in organizing an online workshop that has realized the intended learning outcomes, where the participants were satisfied with the program and organization. We have learned a lot from this workshop about collaborative online learning and how to design this, in particular when using a design thinking approach. This experience shows that tools that enable synchronous and asynchronous collaboration in groups, such as interactive whiteboard and video conferencing, can support valuable learning experiences online. We were able to define a number of the benefits of online workshops which show that, in the future, this type of activity could be used more often and not exclusively in crisis situations. For example, we recommend this course design for exploration in regular teaching courses as well. Nevertheless, the participants and the organizers all have missed the social component of face to face events, in particular the contacts that participants would have built up with each other and other team members, not only in the learning context but also outside the strict working sessions. More research and development is needed to learn more about how this could be accomplished in an online setting.

The original workshop in Lublin aimed to cooperate with local organizations providing the challenges which will result in a contribution of our workshop to a local Lublin community. In the online version this local character was lost. Instead, the cases were formulated by facilitators to be more connected to the interests and everyday experiences of the participating students. Many challenges therefore circled around themes of sustainability, health (also the novel coronavirus), and educational innovation. We do, in fact, highly recommend cooperation with real organizations that would provide challenges for design thinking workshops online. Perhaps by promoting this cooperation with organizations from a variety of locations, rather than from just one location, online events could have a global instead of a local character.

The perspective of the eleven DT.Uni facilitators remains to be analyzed. Their ongoing intervention in the teams that met in their own breakout rooms, working directly on briefs of their own creation, as well as their involvement as organizers would be a valuable contribution to this study since they make up 25% of the total of 44 students, professors and researchers involved in the event.

The carefully planned redesign of the face to face to the online workshop has created the desired learning effect. In connection with the uncertainty of the times this gives a good perspective to be able to keep on learning and organize learning events at any time, and have fun doing both. Our results show that time online is not a restriction and that longer online events would be feasible. However, with the available technology and knowledge, we did not succeed in sufficiently substituting the social component of a face to face event, in particular outside the working hours. We also did not manage to create the dimension of connectivity with any local society that a workshop on location would have made possible. With time, we will learn how to do this online. Nevertheless, this experience shows that online events can be very inspiring, fun, and even flexible in connecting people in cognition and creation through space and time despite being disconnected from any common physical environment.

Glossary

Bootcamp	– Another term for a gathering focused on applying new strategies and activities
Design brief	– A document that outlines the aim and scope of a project
Design Thinking	– A human-centered process for creative problem solving
DT.Uni	– Design Thinking Approach for an Interdisciplinary University
Facilitator	– The project partner who guided the teams
HEI	– Higher Education Institution
Stakeholders	– Those affected by the problem that could benefit from a solution (e.g. students, researchers/academics, and management/administrative staff)

Acknowledgements

This work was done in collaboration with all partners of the DT.Uni project. We acknowledge here in particular the colleagues who were alongside the authors of this article as facilitators of the online workshop: Olga Pliszczynska (UMCS), Charmaine Stint (BCU), Robert Fischer (TUDresden), Kari Joensen (Bifröst), Jón Freyr (Bifröst), Alessandra Talamo (Sapienza), Brigita Boorová (UEBA), Anna Veszprémi Sirotková (UEBA), and Joanna Gorka (UMCS) who did most of the organization for the workshop as DT.Uni project leader. The International Students Workshop was given on the UvA Zoom platform.

The DT.Uni - Design Thinking Approach for an Interdisciplinary University project (reference number: 2017-1-PL01-KA203-038527) has been co-funded by the Erasmus+ Programme of the European Union.

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