Using Design Thinking to Redesign the Educational Experience

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Abstract. In a world that is ever changing and full of uncertainties, there is an undeniable need to equip students with competencies that exceed cognitive knowledge, thus enabling them to develop their individual potentials. Using case study methodology, Design Thinking and Problem-Based Learning, this paper presents a program that brought together students and teachers from different faculties with the purpose of developing innovative solutions to important and pressing societal challenges. Given the unprecedented context generated by the worldwide spread of SARS–COV2 Virus, the program challenged students to find solutions to redesign the educational process. The aim was to equip them with the skills and competencies necessary to adapt in a globalized world, where remote work with team members from different backgrounds is the norm. The Problem-Based Learning approach and the visually attractive collaborative online platform used to implement the Design Thinking methodology generated an overall increased student engagement and creative solutions for wicked problems.

1 Introduction

Today's world is characterized by change. Change in technology, in economies, in job requirements, and so on. Thus, education has to keep up with the skills needed in the labour market.

On the one hand, with so much new knowledge created, one might be tempted to think that the information itself is no longer important, but rather the way of knowing it. On the other hand, skills and knowledge are not separate, but interconnected. Knowledge helps recognize the structure of a problem [1]. Also, to think critically students need domain specific (content) knowledge. Thus, students need exposure to different examples in order to be able to apply their understanding to new situations.

In the attempt to teach 21st century skills, educators are trying to create more experiences for students (asking them to work in groups and/or with new tools). Along these lines, student-centred methods (such as Problem- or Project-Based Learning) seem to be the right answer, because they allow students to work on real-life problems and engage

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with a certain community. However, data shows that most of the time is seatwork and whole-class instruction led by the teacher [2]. Add to this the forced switch to online teaching, as a consequence of the social distancing required by the Covid-19 pandemic, teachers' lack of training in online teaching and knowledge about different platforms and tools, and the bored students (who seek more engaging experiences). What can be done? How can we adjust to this new setting? How can we increase student engagement during class? Therefore, the aim of this paper is to discuss the impact Design Thinking might have on the students' engagement and the overall educational process.

2 Challenges for online teaching

The abrupt switch to online teaching brought about by the Covid-19 pandemic challenged students and teachers alike. Faced with the necessity to reinvent their interaction, the two parties had to overcome different challenges: the new environment, unknown tools and apps, stress and fear of the new virus and overall uncertainty.

2.1 Challenges for teachers

One year ago, most educators had to face a disruptive change, consisting in adapting to online teaching. Even if some of them had already introduced in their current teaching methods different online tools, this new situation was totally different. Previous research on using ICT tools in education already pointed out the necessity to adapt them to the environment, in order not to exacerbate existing divides within an education system, between students, according to their families' affluence [3]. So, on one hand, educators had to understand and accept the dictum "Maslow before Bloom", whereby students can reach the highest learning objective only after their physiological and safety needs are ensured [4]. But, on the other hand, these uncertain times were causing anxieties for educators as well, more so if technological challenges generated additional stress.

A research among professors of the Lucian Blaga University from Sibiu, regarding the major challenges during this pandemic, indicated adapting their classes, that is, their content to the online environment, finding new materials for class, overcoming the difficulties that arise from indirect interactions with the students and lack of feedback, monitoring students' progress and their final evaluation. So, the main concerns evolved around the adjustments required for the new online teaching environment, even if some "desirable difficulties" during the process might prove efficient for learning [5]. Additional challenges arise, as some research indicates, from the intrinsic weaknesses of the digital technologies. "To get the most out of the digital revolution, countries also need to work on the "analogue complements. […] When it comes to the use of technology in education, educational systems may therefore be fated to exist effectively in a state of permanent experimentation" [3]. But there is also a bright side: the new technology enables educators to support and learn from each other, as digital practices are portable and, with a more collaborative mindset it "allows for teachers to learn about new digital tools, to integrate new teaching activities (both high-tech and low-tech), and to share responsibility for creating online or take-home resources" [6].

2.2 Challenges for students

E-learning became a solution that most universities adopted to continue the educational process during the Covid-19 pandemic [7]. This implied that both students and teachers had to change their teaching and learning methods [8]. These changes facilitated education but

also generated frustrations and tensions both for educators and students [9]. In this context, the behaviors of all parties involved in the educational process need to be altered and therefore constructive and creative interventions are required [10].

The differences between e-learning and traditional face to face learning have been researched and among the benefits of e-learning flexibility, low costs and no need to travel to school are mentioned [11]. Nevertheless, the literature identifies drawbacks of e-learning such as computer illiteracy, digital divide and inequities in access to technology [12], lack of intimacy both for students and educators [13], mental and physical health issues, lack of socialization, need of attention, assistance, and support from the community, family, and tertiary institutions [14], [15]. The quality of the on-line education process is not entirely related to the abilities and skills of teachers, but also on the involvement and commitment of students and their technical competencies. The impact of online education as compared to face-to-face teaching and learning has been researched [16] and studies show that students experience loss of concentration and lower performances [17].

3 What is Design Thinking

The term Design Thinking is widely used nowadays, both in the academic and business environment, at conferences, workshops or in the classroom. According to Stanford's D-School [18], "design thinking is a methodology for creative problem solving". A "human-centred 'open' problem solving process used to solve real world 'wicked' problems [19], [20]. The Hasso Plattner Institute [21] has a wider point of view, describing design thinking as "an approach and a mindset to drive meaningful and sustainable transformation processes in business and society". Still, literature review has revealed that a generally accepted definition is still lacking.

Within academia, design thinking can have a positive influence on 21st century education across disciplines because it involves creative thinking in solving complex problems. Thus, it is useful in developing the needed skills (communication, teamwork, creativity, critical thinking / problem solving) to succeed in this interconnected, digital world we live in, because it enhances students' problem-solving skills [22]. As educators, we want our students to be able to analyse, synthesize and innovate, in order to adapt to or solve real-world problems. Creativity and innovation are important attributes of design thinking, highlighted in most articles as well as in expert practitioners' opinions. At the same time, there's a "lack of theoretical and methodological rigor regarding this concept, rather than practical relevance" [23]. In the business environment it has caught attention because the design of products and services is a major component of business competitiveness [24].

Design thinking is an iterative, exploratory, and sometimes a chaotic process [25]. It starts from "a brief" and ends with the description of a product, after going through cycles of adjustment between specifications and solutions until a final solution is reached [26]. During the design process, designers need to understand what to focus on and what is relevant, extracting sense from the available data and observations until they are able to make decisions, adapt to constraints and generate solutions. It involves cognitive operations such as generation, exploration, comparison, and selection [27]. First it widens than it narrows the "problem space", generating solutions, analysing them to the goal, comparing or even refining them until an optimal solution is reached.

Besides being an approach to product innovation, design thinking can improve decision making in projects where social innovation and social impact matter [28]. Innovation and wicked problem solving are achieved by bringing people together from different departments and/or organizations [29], the integration of different perspectives being a key attribute of design thinking [30].

As regards the tools and methods common to design thinking, after an extensive literature review and a validation process with seven designers (all design directors or senior designers with 15 to 25 years work experience), Pietro, Wilner, Bhatti, Mura and Beverland [23] narrowed the initial 37 tools and methods identified to the following 8: ethnographic methods, personas, journey maps, brainstorming, mind maps, visualization, prototyping and experiments.

4 Problem Based Learning

Problem-Based Learning (PBL) was first developed in medical education in the 1950s [31] for better preparing students for real-life problems. Throughout the 1990s, Problem-Based Learning has been adopted in higher education (outside the medical field) and in K-12 settings.

Problem-Based Learning is focused on a problem, so that knowledge is stimulated by the problem and applied back to it. It is student centred, generating and evaluating learning issues through self- and peer assessment. Tutors are facilitators, supporting processes and probing students' knowledge without providing direct answers to questions. Problem-Based Learning contributes to higher order thinking and problem-solving skills [32]. By requiring students to talk to each other and collaborate on the project it contributes to student engagement [33]. However, it seems that it contributes less to knowledge acquisition (recalled content) [34].

In 2006, Hung introduced the 3C3R model (figure 1) as a conceptual framework for systematically designing optimal Problem-Based Learning problems. The model focuses on knowledge content, context and integration (connection), as well as on students' acquisition of it through researching, reasoning, and reflecting.

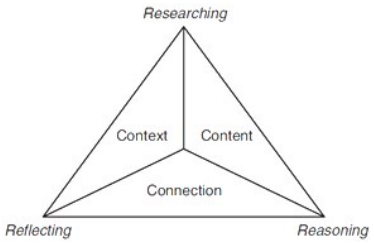

Fig. 1. The 3C3R Problem-Based Learning problem design model

Hung also developed a step-by-step process for operationalizing this model. The first step is to set goals and objectives. Then, one should analyse content and context. After selecting or generating the Problem-Based Learning problem one should perform problem affordance and correspondence analyses. Then, conduct calibration processes, reflect and examine the inter-supporting relationships of the model [35].

5 Methodology

In elaborating this paper, the authors approached the subject as a case study. The choice was made as this methodology is suitable for explanatory research questions, indicating the why and the how of complex situations. In other words, "an empirical inquiry about a contemporary phenomenon (e.g., a "case") set within its real-world context – especially when boundaries between phenomena and context are not clearly evident" [36]. In this case, students were asked to find solutions to online teaching during the pandemic, as part of a class assignment.

During the first semester of the 2020-2021 academic year, Lucian Blaga University of Sibiu organized Sibiu Impact Makers - a program that brought together key-players and actors from the Sibiu community with the purpose of developing innovative solutions to important and pressing societal challenges. Given the unprecedented context generated by the worldwide spread of SARS-COV2 Virus and the Coronavirus Disease Covid-19, the program addressed a pressing issue of the academic community - to reinvent education in the context generated by the pandemic.

The main purpose of this challenge was to understand students' view on online teaching, hoping to gain insights on what might motivate them to engage more in the teaching - learning process. Thus, the authors decided to use the Design Thinking methodology, because it is an open problem-solving process, which allows students to deal with real-world challenges. The requirements of social distancing implied new approaches to teaching: a new environment, new tools and most likely, a new mindset regarding the relationship between students and educators, which were, in terms, affected by a 'tsunami' of uncertainty. Students had the chance to think about solutions for teaching during the pandemic, even by asking and involving educators from three faculties of our University.

The program consisted of three parts. During the kick-off meeting members of academia, students from different study programs (of all ages), young leaders and entrepreneurs met and learned how the design challenge can be used to generate solutions for problems that can be seen in the community. The purpose was to introduce them to social entrepreneurship, social innovation and to the general aspects of the design thinking methodology. 119 of the 127 participants were divided into 24 mixed teams, while 8 students had the role of Account Managers, monitoring and motivating 3 teams each. The kick-off event also included a training for using the digital workspace for remote collaboration (Sprintbase).

The 127 participants came from 3 faculties within Lucian Blaga University of Sibiu: 39 students from the School of Economic Sciences (Business Administration – year 2 and Marketing – year 3), 34 participants from School of Social Sciences & Humanities (Communication & Public Relations – year 3 and Human Resources – year 3) and 54 Engineering students (Economic Engineering in Mechanical Field – year 3). The students hadn't met each other before and the teams were mixed and randomly assigned, aiming to familiarize the students with the challenges [37] that their future jobs might bring in a dynamic, internationalized and ever-changing working environment [38].

The teams worked together for 7 weeks and had 1 hour per week of lecture and 8 hours of practical/seminar activities. Each week the lectures covered phases of the design thinking process and the students were offered guidance and customized support throughout the process. Each team had a coach that managed the online tool and guided the students through the process.

The used platform, where the teams could interact was Sprintbase, a collaborative and interactive environment, which permitted synchronous and asynchronous inputs. This virtual environment permitted a direct observation of the teams' progress, by the authors. The idea behind the task was that, in the majority of cases, the solutions came from the educators' side, while the authors consider teaching as a bilateral, associative process, so that both parties should be included in exploring possible solutions.

Thus, using Problem-Based Learning permitted the evaluation of learning issues through self- and peer assessment.

6 Results

The challenge was to find solutions to reinvent education in the online environment, in the context generated by the Covid-19 pandemic. In the first stage of the design thinking

process, the 24 teams of students had interviewed 144 students, teachers and other stakeholders affected by online education. An interview guide was developed in class, but the design thinking methodology allows participants to adapt their questions according to the context of the interview to empathize more with the interviewee. The participants understood the importance of empathy and generated user personas and empathy maps. Then they formulated insights and "how might we…" questions, narrowing down the problems that they identified in the market. Multiple solutions were generated, and each team proposed at least one prototype that was tested with an average of 7 users.

The students identified innovative solutions in the context of Covid-19, focusing both on systemic problems and on challenges in the education sector. The deliverables are 24 project reports and 24 PowerPoint presentations which have been generated from 1976 contributions. Each student uploaded on the platform interviews, desktop research summaries, empathy maps, user personas, insights, "how might we…" questions, concepts, proposed solutions, prototypes, feedback grids and elevator pitches, generally referred to as contributions (see figure 2).

Interview transcript Empathy map User persona

Fig. 2. Examples of student contributions on the collaborative platform

The average number of contributions per team was 82.3, ranging from 37 to 193, as shown in figure 3.

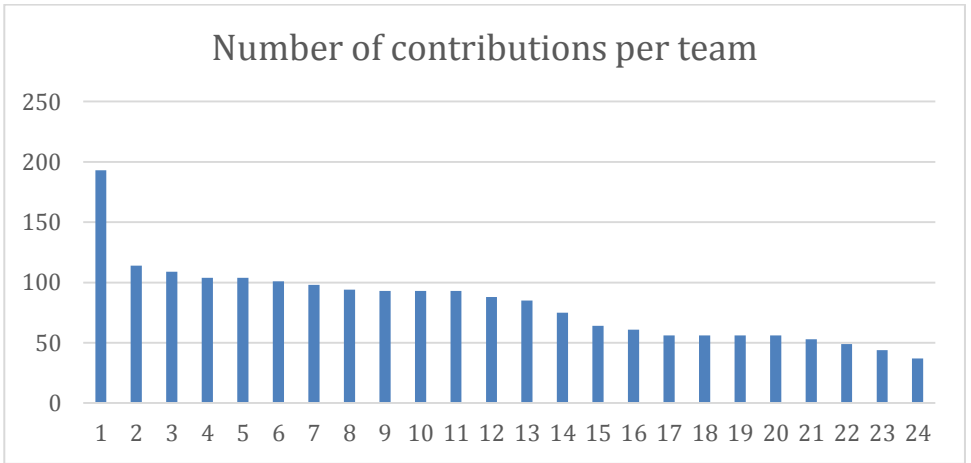

Fig. 3. Number of contributions per team on the collaborative platform

The differences between the teams and individual involvement has been explained by the students. The most active teams claimed that the team leader was responsible with motivating the team and engaging each participant. The effort to spend time getting to

know fellow team members, share personal experiences and challenges proved to be essential in the satisfaction of the participants and the quality of their output.

The average number of contributions per participant is 17.3, ranging from 1 to 54. Figure 4 shows a screenshot of the workspace of one of the 24 teams, where students organize their contributions.

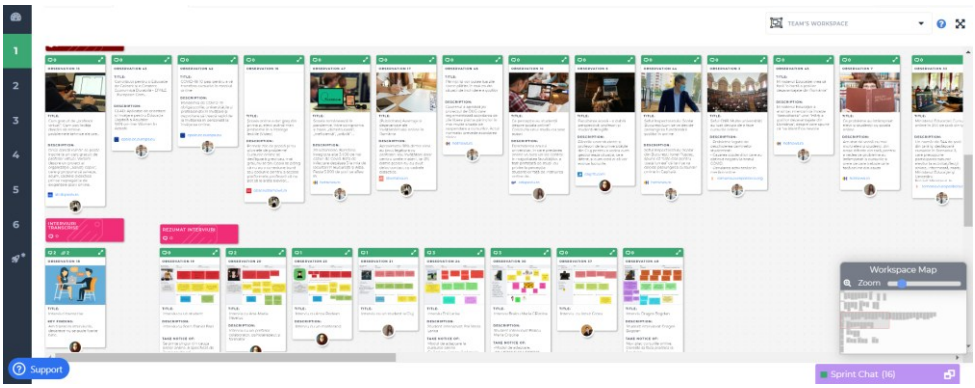

Fig. 4. Contribution of one team on the collaborative workspace

Out of the 144 interviews carried out by the 24 teams and documented on the platform, the most frequent struggles mentioned by students have been synthesized in figure 5. Lack of interaction has been mentioned by most students who participated in the interviews, while the second most common concern was the unadapted teaching style which led to increased screen time, mental and physical stress, emotional issues and frustrations. Besides education, students observed that online education affected their social lives and their personal time which has been reduced during this period.

The solutions proposed by the 24 student teams range from the introduction of educational games in the teaching process to make the course more interactive to much simpler approaches such as reminders to step away from the computer and exercise. Technical difficulties that the professors displayed during the online education have also been addressed by the students who suggested training for their professors, or even came up with entrepreneurial approaches and proposed potential businesses that help lecturers transform their didactic materials and teaching methods into some online friendly teaching resources [39]. During the field research phase some teams identified that internships became a challenge in the context of the Covid-19 pandemic. Many of the internship agreements have been suspended during these challenging times and students proposed innovative solutions to solve this issue, such as “first person” computer games that simulate the experience that students would have in a production unit, thus helping them to understand the manufacturing process.

Other solutions proposed by the participants for improving online education include gamification, using collaborative platforms to improve working in teams, introducing fast anonymous feed-back forms to improve the interaction between students and professors or establishing support groups where students volunteer to help each other with assignments but also to offer emotional support or to create socializing opportunities.

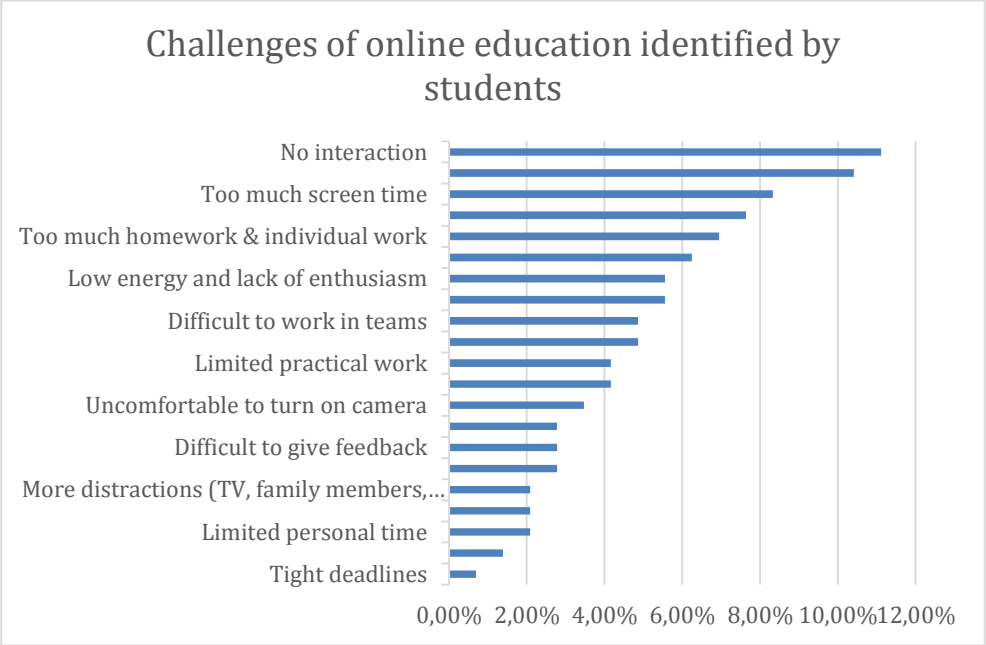

Fig. 5. Challenges faced by students during online education

7 Conclusions

Both students and teachers had to adapt to the changes generated by the Covid-19 pandemic when online education became an important alternative to traditional education processes. This paper shows the challenges and frustrations generated by this new context, highlighting disengagement, loss of focus, anxiety, physical and mental problems and above all a decrease of the quality of the educational process. The program presented in this work is an educational approach that aims to equip students with skills and competencies necessary to adapt in a globalized world, where remote work with team members from different backgrounds is the norm. The Problem-Based Learning approach and using a visually attractive collaborative online platform to implement the design thinking methodology generated an overall increased student engagement and creative solutions for wicked problems.

During this first iteration of the program several lessons were learnt. Introducing the design thinking methodology through an online collaborative platform had a positive impact on the educational process. However, the approach had several limitations. The experience was perceived differently by students; some of them were enthusiastic and felt they have learned a lot, while others have provided negative feedback, as they felt they had even more work to do in their already busy schedule. The teams that had an enthusiastic team leader had more contributions to the process, were more engaged and offered better feedback. The 8 account managers were not as motivated as they were expected to be and they were not as attached to the design challenge as the other participants. Thus, should we implement such a program again, we have to find a better way of making them understand their importance in the process, as well as better motivate them.

Further consideration should be given to the gamification approach, as it created, at times, a highly competitive environment. This experience also indicates that the choice of the challenge is critical for students' involvement. Some previous knowledge on the subject

might diminish the anguish, while the belief that they are doing something important for them and others contribute to their motivation. Future implementation of the program should also include a comprehensive and holistic approach of Design Thinking methodology, so that students can better understand where they stand in the process, at every given time. Furthermore, an increased attention to developing soft skills, like teamwork and communication, should include a more coordinated effort. For example, team building exercises might contribute to a greater group cohesion, which should improve in turn the communication within the team [34].

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