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Design Thinking Concept in higher education sector: A comparison of a representative the Polish and the American university

Design Thinking Concept w sektorze szkolnictwa wyższego: porównanie przedstawiciela uczelni polskiej i amerykańskiej

ABSTRACT

Design thinking is an instrument for promoting innovation in business and also a new and important approach in education. Design thinking is a creative process, which enables the student to improve innovative personalities and will also help to create contemporary educational tools. Based on the query of the literature review, the authors of the article noticed the presence of this issue in the works of theoreticians, and at the same time they stated noticeably lack of indications for the implementation of these findings and possibilities and their verification in practice (educating specialists and students). As traditional education and learning tools are not sufficient, therefore the importance of design thinking is increasing in high education sectors, despite the implementation of this topic at universities and business schools being very slow. This study compares the courses at Hasso Plattner Institute of Design at Stanford University (d.school), as the leader in the field of design thinking, and Wroclaw University of Science and Technology. Using a case study approach, could assist the researchers in understanding the gaps and provide suggestions for improving the courses in a Polish university in comparison with the leader of design thinking.

Keywords: design thinking, high education sector, curriculum development.

STRESZCZENIE

Myślenie projektowe (ang. *design thinking*) jest instrumentem promowania innowacji w biznesie, a także nowym ważnym podejściem w edukacji. To proces twórczy, który umożliwia uczniowi doskonalenie innowacyjnej osobowości, a także pomaga w tworzeniu współczesnych narzędzi edukacyjnych. Przeprowadzając przegląd literatury, autorzy artykułu zauważyli obecność tego zagadnienia w pracach teoretyków, a jednocześnie stwierdzili zauważalny brak wskazań do wdrożenia tych ustaleń oraz ich weryfikacji w praktyce (kształcenie specjalistów i studentów). Ponieważ tradycyjne narzędzia edukacyjne nie są wystarczające, w sektorach szkolnictwa wyższego rośnie znaczenie myślenia projektowego, mimo że wdrażanie tego tematu na uniwersytetach i w szkołach biznesu jest bardzo powolne. W niniejszym opracowaniu porównano kursy prowadzone w Hasso Plattner Institute of Design na Uniwersytecie Stanforda – lidera w dziedzinie myślenia projektowego – oraz na Politechnice Wrocławskiej. Zastosowanie podejścia opartego na omawianym tu studium przypadku mogłoby pomóc naukowcom zrozumieć różnice między instytucjami, zauważyć luki na polskiej uczelni i zaproponować na niej poprawę kursów.

Słowa kluczowe: design thinking, sektor szkolnictwa wyższego, rozwój programów nauczania.

INTRODUCTION

Recently, design thinking is one of the most important trends that extend to many markets and companies worldwide. It encompasses the different types of creative strategies for managing multi-stakeholder projects or promoting organizational innovation and can help deal with doubtfulness, and uncertainty, formulate the right questions, as well as identify and develop possibilities and potentials (Grots & Creuznacher, 2016). It is also a one problem-solving approach, especially for difficult and outrageous problems (Rauth et al.,

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2010). The purpose of design thinking is to overcome the barriers of the problem to make sure that the right questions are provided. The process forecasts steps that enable participants to analyze, incorporate, divide, and develop insights from different areas through designing, testing, and storytelling (Brown, 2009). In the design thinking process, participants will be inspired to use limitations as encouragement (Brown & Wyatt, 2010). The result of this process is a new integration of signs, actions, and environments (Buchanan, 1992). Renard (2014) mentioned that design thinking has a background in different disciplines and is related to different areas like engineering, architecture, and education in the literature review. The nature of design thinking leads the participants to focus on working and thinking to boost different aspects such as civic education, empathy, perception, and courage (Sharples et al., 2016). Skaggs (2018) defined those human needs as being able to be understood with observation and experience and this causes the creation of the products. Design thinking will be applied to analyze different scenarios and solve business, to increase productivity in a new, intuitive, and powerful way. And this is the most important impact of growing designed experience (Hodgkinson, 2013). The concept and expected learning result of design thinking varies among different professionals (Taheri et al., 2016) and many authors believe that there is a lack of systematic and stable descriptions for it (Kimbell, 2011; Micheli et al., 2018; Taheri et al., 2016). There are also some restrictions regarding detailed process-oriented representation and description of its practice (Carlgren et al., 2016). Design thinking offers a new approach to innovation and problem-solving, therefore specialists and scientists have a lot of interest in it. However, there seem to be significant differences between advocates and critics regarding essential characteristics, relevancy, and results. (Micheli et al., 2018). While emphasizing the importance of design thinking as an important trend (tool) in the process of interdisciplinary education of specialists for the purposes (needs) of project management, the cited ones recognize a specific asymmetry between the theoretical contribution to the development of this trend and the practical aspects related to the implementation of theoretical concepts (conclusions) into practice (organizational reality). Design thinking in education is also very important even considering the lack of conceptual transparency and clarity. For example, previous research shows that at over sixty universities in the US and colleagues, design thinking is trained through workshops, additional training, courses, and programs (Goldman et al., 2014). In addition, it was observed that design thinking is also applied in K-16+ curricula (is a movement in the United States to bring together the various levels of education for younger students, namely between the K–12 and the post-secondary education systems) to guide the following skills such as Critical thinking, Creativity, Collaboration, Communication, Information literacy, Media literacy, Technology literacy, Flexibility, Leadership, Initiative, Productivity, and Social skills (Callahan, 2019). So, because of the wide connection and relation in many disciplines, design thinking grew into an educational phenomenon in higher education rapidly (Beligatamulla et al., 2019). Regarding this topic, it is important to define, how design thinking can be applied in different educational settings. In this article, applying the design thinking in Hasso Plattner Institute of Design at Stanford University known as d.school (HPI D-School)– the leader in Design Competency and Design Thinking in the high education sector, with Wroclaw University of Science and Technology (WUST) – lead representative, will be compared.

1. DESIGN THINKING

Although the concept of Design Thinking has appeared in the literature on the subject recently, because it appeared at the end of the twentieth century, works in this area provide the foundations and constitute a temptation to outline theoretical frameworks that could constitute the basis for further useful research, specially dedicated to practicing field. In the highly technologically competitive world, it is necessary to learn, expand and use different types of skills to be successful (Shute & Becker, 2010). Design thinking is one of these most essential skills. Design has been broadly viewed as the central activity of engineering. (Simon, 1996). Many specialists also considered that engineers need to design effective solutions after graduation and they should be able to understand and cover social needs (Evans et al., 1990). Design is also an activity in which humans are the major aspect in problem-solving. The design process starts with understanding and analyzing the needs and dissatisfaction and focus on the actions to find proper solutions to solve the problems. From this point of view, many scientists have designed and acted throughout their careers as designers, although often they were not aware of or realized that they were involved in the design process. Design thinking has also become increasingly important in the business environment. This is because product and service design are an important part of business competitiveness as many well-known companies have committed to becoming design leaders (Dunne & Martin, 2006). Design thinking is now an essential part of the design in the economy, it has also a positive influence on education as it includes creative thinking in generating problem solutions. This means, that students have to analyze and think logically and be able to solve complex problems in an academic environment (Rotherham & Willingham, 2009). In this matter, coaches, professors, and lecturers should support students in learning, developing, and improving their Twenty-first century skills in this digital world and prepare them for their careers. Twenty-first century skills include skills related to Critical thinking, Creativity, Collaboration, Communication, Information literacy, Media literacy, Technology literacy, Flexibility, Leadership, Initiative, Productivity, and Social (Rotherham & Willingham, 2009; Shute & Torres, 2012). All these skills are

in accordance with the theory of situated cognition (Lave & Wenger, 1991), theories of development (Piaget, 1972), and constructivism (Bruner, 1990), which is a learning approach that assumes that people are actively constructing or producing their own knowledge and that reality is set by the experiences of the learner (Elliott et al., 2000). It can be considered that the individual and collective successes are increasingly dependent on such skills, therefore in the business environment, design thinking became more attentive in different fields like engineering, and architecture, and at universities became an important subject because it can change how people learn, analyze, and can solve the problems. (e.g., Dym et al., 2005; Fricke, 1999; Nagai & Nagouchi, 2003). The field of design competence and design thinking are also receiving more interest in design research and an enormous number of papers and articles have been published on these topics (e.g., Do & Gross, 2001; Goldschmidt & Weil, 1998; Owen, 2007; Stempfle & Badke-Schaube, 2002; Tang & Gero, 2001). There are also many papers and studies of specialists or experienced designers about the processes of beginners in comparison with expert designers (e.g., Cross & Cross, 1998; Ericsson & Smith, 1991; Ho, 2001). Within this large body of design thinking research, there is a lack of comparison of studies in the high educational sector at Polish universities in comparison with other universities.

Conceptualizations of Design Thinking

Several researchers offer the approach to the cognitive processes that are mentioned in design thinking. For example, one study has proposed that design thinkers apply a procreative process of conceptualizing driving the idea creation process. Imagining and conceptualizing are based on analytical collaborative thinking and fantasizing (Bauer & Eagen 2008). The ability of switching between constructive and abstract thinking modes is the central topic of design thinking (Cross, 2019). Also, various forms of intelligence like logical mathematics, musical, physical, kinesthetic, and personal can be used in design thinking (Cross, 2010). Based on the literature review, a wide range of thinking skills and styles are related to design thinking, for example, constructive thinking, critical thinking, divergent/convergent thinking, and aspirational thinking (Cross, 2019). In 2008, a model of cognitive processes was presented. Design researchers were working with psychologists on this type of process, which includes evaluation assessment, search, structural, visual thinking, and design analysis (Goldschmidt & Badke-Schaub, 2008). Design thinking as opposed to scientific thinking includes comparative, deductive, and abductive thinking, and through them, a designer can build a new concept and instruction to approach facts and facilities (Dunne & Martin, 2006). Design thinking is also a creative thinking process because design thinkers are believing in analytical processes and having the competencies to understand all aspects of a problem and merge new solutions and improve the existing alternatives (Brown, 2011).

Design thinking in high education sectors

In recent years, the importance of teaching and learning design thinking at universities and colleges has increased, however a small number of studies have been published on the learning and teaching aspects of Design Thinking. A wide range of literature is focusing on learning, teaching, and evaluation methods, and practices that help gain the design thinking competencies. Research has shown that the teaching of design thinking has a potentially positive impact on business and management education. It has been argued that management has many similarities to design and design approaches are applicable to management. These methods are new and can drive innovation in the companies, therefore high education sectors in the field of management and business should increase and develop new courses in design thinking (Dunne & Martin, 2006). As part of a design thinking model, students would be motivated to look at problems broadly, perceive the user's behavior deeply, and see the value of others' contributions (Dunne & Martin 2006). This kind of motivation will be achieved through an "epistemological pluralism", which consists of standard models of teaching that are already existing at the business schools. Several engineering schools have developed approaches to teaching design thinking. Several engineering schools have built methods to teach design thinking. D.school at Stanford university can be mentioned as an international leader for developing and incorporating design thinking. In the studies, the main philosophies and applied models have been described in the design thinking programs at Stanford's School of Engineering, and it has been found that the teaching of associative cooperation is essential and elemental to this approach. In the design thinking courses, students will learn in interdisciplinary teams to solve a given design problem by exploring their problem space in a practical way (Plattner et al., 2011).

In the context of learning, the educational value of design thinking is based on an ongoing process to generate ideas, forecast the outcomes, test, and finally hypothesize (Johansson-Sköldberg & Woodilla, 2013). This process includes analytical and synthetic aspects and works in both theoretical and practical areas. In the analytical steps of design, students will focus on findings and understanding. In the synthetic steps, the students will concentrate on creativity and inventing (Beckman & Barry, 2007). Indeed, it is evident that by going through all steps of the design thinking process, students will develop their competencies in all four critical skills that are considered to be the most important for the formation of twenty-first century skills rather than the four Cs (National Education Association, 2014), which are as followed:

- Critical thinking,
- Communication,
- Collaboration,
- Creativity

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5 Steps of Design Thinking

The origins of design thinking go back to the 1960s, and the term came up for the first time in a book entitled 'Design Thinking' (Rowe, 1987). Since this time, several models of design thinking have been developed. The design thinking process is consisting of five phases Empathize, Define, Ideate, Prototype, and Test (Hasso Plattner Institute of Design, n.d.). The design thinking process is Human-Centered Design. In the phase of empathy, the user's experience and the target audience's needs should be deeply understood and the findings from this phase are processed and merged in the step of defining to build a user perspective and define the problems. In the ideate phase, designers brainstorm and explore a range of possible solutions. In the ideate phase, based on a problem statement from the previous step, the possible solutions should be conceptualized and created. After the ideate phase, the ideas are converted into a tangible form for users to experience and interact with. This phase is called prototyping. Finally, in the testing phase, all observations will be considered, and feedback clarified. It is important to mention that design thinking is constant progress of development and reflection, and in many cases, all 5 steps are not necessarily sequential. In higher education sectors, there is a growing interest in design thinking and there is a growing number of universities and business schools that are teaching the design thinking methodology so that students can gain skills to achieve innovative design tasks. In particular, it is increasingly used in management and engineering courses (Dunne & Martin, 2006; Dym et al., 2005).

Figure 1 is presented the design thinking process, which is broken down into five stages and is not a linear process. In each stage, new discoveries will be made, that repeating previous stages might be required.

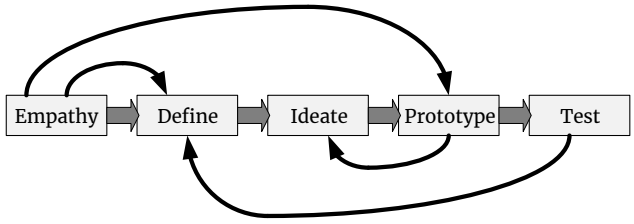

Figure 1. 5 Stages in the Design Thinking Process
Source: Dam & Siang (n.d.)

2. METHODOLOGY

This paper utilizes a case study with the intention of comparing and analyzing the courses at d.School of Stanford University and WUST and seek to encourage design thinking in their educational approaches. The Hasso Plattner Institute of Design at Stanford, commonly known as the d.school, is a design thinking institute based at Stanford University. David M. Kelley, the program's founder, stated; "What we, as design thinkers, have, is this creative confidence that, when given a difficult problem, we have a methodology that enables us to come up with a solution that nobody has before" (Roethelr, 2010). In 2005, the d.school was founded and is considered the leader in human-centered design and a leading teaching institute for design and experiential education. Project Fellowship was launched in 2012, which invites specialists with expertise in their respective fields to join the d.school to proceed with a determined project in their sector and make system-level changes. In the last five years of management of the fellowship, curricula, and approaches had been developed to provide the best possible support for fellows. Today, more intensive workshops are expanded at d.school to support more social entrepreneurs and system intrapreneurs (Stanford Engineering, n.d.). The most important advantage of d.school is that all students from all seven Standford schools, whether they are undergraduate, graduate or Ph.D. can attend the design thinking courses and improve their skills in their field and have challenges (Hasso Plattner Institute of Design, n.d.). In 1945, the Polish Technical University of Wrocław was established. A group of 27 professors from Lviv University and Technical University came to Wrocław and founded the Polish Academic Society. Now, the university offers education in 13 faculties with more than twenty-six thousand students and three branches under the supervision of almost 2,200 academic teachers: Faculty of Architecture, Faculty of Civil Engineering, Faculty of Chemistry, Faculty of Electronics, Faculty of Electrical Engineering, Faculty of Geoengineering, Faculty of Environmental Engineering, Faculty of Computer Science and Management, Faculty of Mechanical and Power Engineering, Faculty of Mechanical Engineering, Faculty of Fundamental Problems of Technology, Faculty of Microsystem Electronics and Photonics, Faculty of Pure and Applied Mathematics (History - Wrocław University of Science and Technology). The education process related to project management began to be implemented at the Wroclaw University of Technology in the early 1990s at the Faculty of Computer Science and Management, drawing on the experience gained from the Faculty of Civil Engineering, Architecture, and Mining and Chemistry. This activity was developed by stopping activities and the results which resulted with students graduating with the appropriate certificates, obtained after completing the education process, mainly during postgraduate studies.

3. RESULTS

D.School is the main place where people use design to develop and improve their own creativity and find solutions to complex problems. Therefore, first, related courses of Wroclaw University of Science and Technology, mostly in the management department, will be shown in Table 1, which can develop students' ability regarding design thinking:

In general, the courses vary from year to year according to the teaching team's expertise. Some of the courses, which help the students to gain various skills regarding critical thinking, communication, collaboration, and creativi-

Table 1. Related courses for learning experiences in design thinking at Wroclaw University of Technology and Science

Criteria/Courses	Faculty	Program	Duration	Gained skills
Information Systems Analysis	Faculty of computer science and Management	MA	1 Semester	Capable to develop her/his knowledge and skills, to collaborate and to work in groups, ready to identify, analyze and solve problems in information system development projects from a stakeholder/analyst point of view.
Management Information Systems Modeling	Faculty of computer science and Management	MA	1 Semester	Student can create a models of simple computer systems to support management solutions to common problems and issues in the various functional areas of the organization.
Business Data Analysis	Faculty of computer science and Management	MA	1 Semester	Student is capable of planning and implementing the scheme of data analysis referring to the real problems in the business.
Contemporary Management	Faculty of computer science and Management	BA	1 Semester	Student can (at basic level) choose, justify and apply the methods and techniques to identify, analyze and solve complex management and substantive issues in the organization.
Management Ethics	Faculty of computer science and Management	MA	1 Semester	Student can illustrate ethical issues and challenges typically encountered by the corporations in dealing with different stakeholder groups.
Communication in Management	Faculty of computer science and Management	MA	1 Semester	The student is able to formulate ideas in concise ways, prepare a written message for diverse groups of receivers, deliver powerful, convincing speech.
Leading projects in modern organizations	Faculty of computer science and Management	BA	1 Semester	Students will be able to apply the modern project management methods in practice and will learn the fundamental of critical thinking.
Data mining	Faculty of computer science and Management	BA	1 Semester	Student can find methods for solving decision problems, held accountable for his works, defend his views of the proposed way of solving problems.

Source: Own elaboration

ty in both HPI D-School and Wroclaw University of Science and Technology. Based on the subjects of each course, they have been categorized, which competencies will be mainly achieved during the course, however, all skills will be gained during the following classes, but one skill is the main highlighted result (Figure 2):

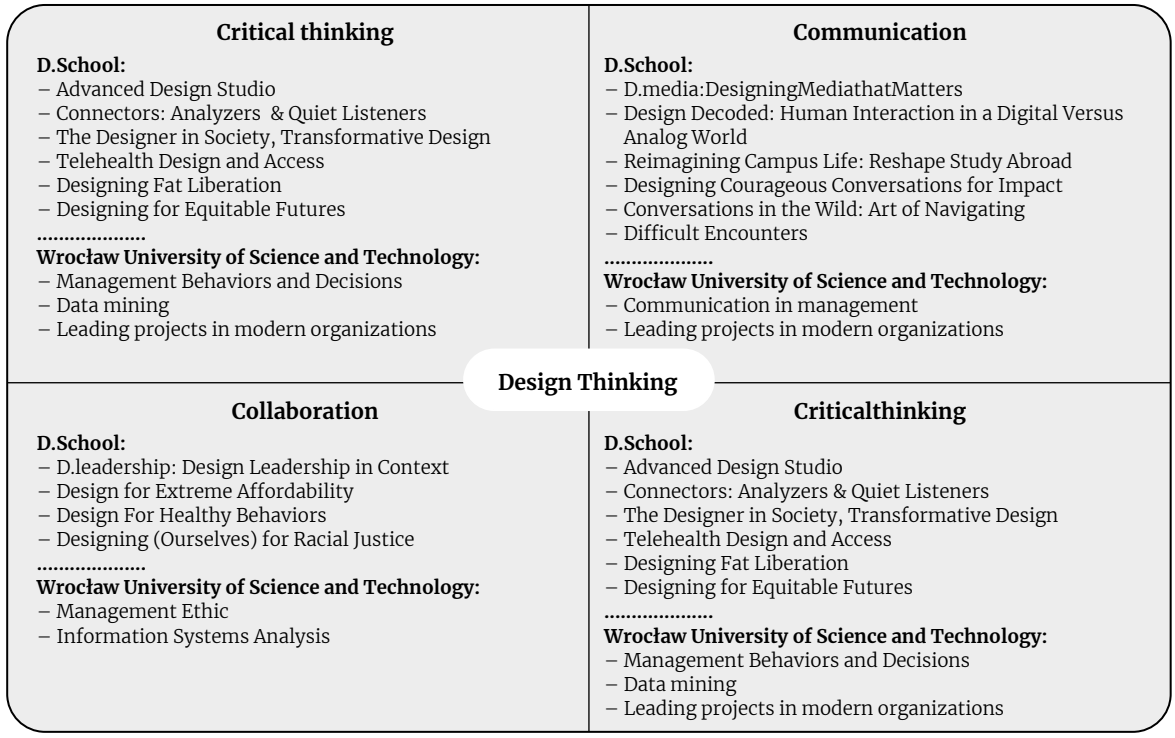

Figure 2. Course comparison between School of Stanford University and Wroclaw University of Science, and Technology and based on four main gain skills in design thinking programs

Source: Own elaboration

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CONCLUSION

Wroclaw University of Science and Technology (WUST) with the utmost care meets the Design Thinking standards set by world universities, especially the School of Stanford University (HPI D-School), regarding the need for education in the field of Critical Thinking, Collaboration, Communication and Creativity, and also taking into account all seven stages of the learning process (Warming, Forming, Informing, Storming, Performing, Reforming and Transforming). The comparative studies clearly show an overlapping picture of slight differences (and similarities) in the teaching of Design Thinking on one hand but also, on the other hand, the type of vector that has an application of point emerge, direction and indication of a fundamental departure from traditional education in favor of design thinking that takes into account both holistic and interdisciplinary thinking knowledge and the need to develop the innovative (creative) activities.

In general, there are noticeable differences; mainly in goals and methods of educating students in the universities of Central and Eastern Europe. Thus, while d.School provides an ongoing process of holistic knowledge, encompassing both Design Competency and Design Thinking to use them in the economy and society, WUST focuses mainly on teaching Design Thinking (selective - "from design to design") addressed to the business sector It seems to be a derivative of several important factors contained in a specific "magic triangle":

1. D.School meets the needs and anticipates the expectations of the global economy, which requires top-class specialists from leaders who understand the current and future development mechanisms of the global economy and economics. WUST, on the other hand, educates students mainly for the needs of the domestic (internal, i.e., Polish) market, and hence the scope, depth, and duration of the educational process are inherently smaller and have an ad hoc, reactive and selective character.

2. D.School is a leading university with a worldwide reputation, WUST is not among the top 500 universities in the world. Hence, both the number of teaching staff and their quality are varied and result from their knowledge and historical experience.

3. D.School students are recruited from all over the world. Their expectations are diversified and they are an "accelerator" for curricula and education. Foreign students at WUST make up a small percentage of graduates (they come from the Republic of China, and India, and in a small number you can meet students from Western Europe and countries of the former Soviet Union), and the level of their expectations is inherently lower than students in economically and educationally advanced countries.

The authors of the article are aware that their pioneering research is just the beginning of an inquiry into the explanation of education systems aimed at teaching Design Thinking. At the same time, they are aware of the limitations of the article resulting from the width and depth (scope) of the per graded issues and they hope that the generalizations contained in the article will be the basis of development for further research. Further intensive research steps should be aimed at providing an answer to the question: of what should be done and how to reduce this difference, which means a significant deepening of the research, especially concerning the identification of mechanisms related to this issue. The results of the findings show that it is worth making such attempts. Research confirms that the emerging trend in design education (Design Thinking) does not seem to be a "one-season fashion", but a fixed canon present in the organizational reality.

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