

The collage features 20 images arranged in a grid-like pattern, with some images being larger than others. The images depict various activities and logos related to the DT Lab project. The logos include 'DT 4U', 'Universidade de Vigo', 'Diamon DT', 'BIBLIOTEK', 'SHOPA', and 'DT Lab'. The activities shown include people working at tables, a person presenting to a group, a red circular sculpture, a snowy landscape, a person working on a project, a group of people smiling, a person working on a project, a snowy landscape, a person working on a project, a DT Lab logo, a group of people smiling, a person working on a project, a snowy landscape, a person working on a project, a DT Lab logo, a group of people smiling, a person working on a project, a snowy landscape.

07 HANDBOOK

Authors: listed in the HANDBOOK (mentors of project consortium)



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Dear readers,

Between November 2015 and October 2017, The Lodz University of Technology, the University of Vigo, the University of Science and Technology in Bydgoszcz and the University of Tromsø have embarked on a common journey to explore design thinking for academy. The DiamonDT project (“Development of Innovative AcadeMy ON the basis of DT teaching”), funded by the Erasmus+ Strategic Partnerships Programme, was the driving force to facilitate exchange, experience and to “tune violins” in students' teaching and teachers' training for future DT teaching or project coaching. The handbook that you are starting to read can be seen as the end point of our common journey. We have entitled it “Good practice in teaching and learning using Design Thinking methodology - a handbook” to reflect our experience in the domain. However, you will not find inside any strong description of the design thinking process and philosophy – this is the purpose of the Textbook and Toolbox items we have also developed during the project. Instead, this handbook has been conceived as a mature reflection of elements that could be taken into account by teachers who will be in charge of design thinking courses or for students who are interested in taking part in such courses. Surveys, interviews and reflective observation of students and teachers during the classes, workshops and summer schools we have organised, have built the foundation of this reflection.

This e-document is built of four sections. The first one introduces a short history of design thinking and how it has emerged and evolved until now in our four institutions. The second section – the DiamonDT journey – presents a visual timeline of the different important steps that have guided the project. Eight different tips structure the third section, which has been thought for (future) DT teachers. Finally, because design thinking will never be the same without students, the fourth section is dedicated to them. There, we hope that you (the students!) will find useful information about DT and its importance to enrich your future career.

We do hope you will find useful this document. Our aim is to enrich it with our growing experience in the years to come.

Sincerely yours,

Dorota Bociąga (*DiamonDT coordinator*)

Laurent Babout

on behalf of the DiamonDT consortium.

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Introduction

DT history in short

Design thinking (DT), a funny name that does not find any proper translation and is used as-is worldwide. How to interpret it? Do we think of a design or do we design a way of thinking? Well, it is a bit of both. One important missing or hidden word is the user, for whom we design a product that meet his requirements and solve a problem he faces (usually we talk about wicked problems). All the story of design thinking is related to Stanford university, where David Kelley and mates thought of a methodology in the 90s that aims at bringing together toolsets and mindsets to discover problems via empathy, synthesize thoughts and define specific problem using abductive reasoning, brainstorm and encourage wild ideas, then prototype and test products to encourage users' feedback. The idea has been around for more than 20 years, but this is in 2004 that the Hasso Plattner Institute of Design, commonly known as the d.school, opened at Stanford University, offering students from different majors complementary soft skills fostering empathy, creativity, teamwork and entrepreneurship. From that time, DT has been widely popularized, mainly in the USA (Berkeley or Harvard), taking different faces and names. For instance, the IDEO company, leader in promoting the methodology and solving problems for companies, names the process Human-Centered Design (HCD), while Jon Kolko at Austin Center for Design (AC4D) names it User-Centered Design (UCD). The idea of having the user in the loop as early as possible in the process has also become a standard, not only in Design, but also in Information Technology, where User-Experience Design (UXD) and Interaction Design have grown in popularity to efficiently design software and human-computer interaction (HCI) solutions.

In the past 10 years, the methodology has also grown all over Europe. France, Finland, Germany, Norway, Poland, Spain and the UK are countries where the methodology has developed and proved its applicability to solve problems at school, university or in the private sector. Notosh Ltd. (created by Ewan McIntosh) has made its reputation by creating a DT approach for kids, before embracing business sector. The Design Council is also a good example of DT application in the UK, where their proposed

approach is built around the double-diamond divergent/convergent principle. The d.school "brand" is also associated with DT workspace in Potsdam (Hasso Plattner Institute of Design) or in Paris (Ecole des Ponts, not so far from Disney Land™, another popular American brand) the former one being also known for its research activity in the domain.

Because DT is about team working and knowledge sharing, the Erasmus+ Strategic Partner has been a very supportive platform for the four following universities to share experiences in design thinking teaching and elaborate a common vision, which is reflected by this handbook.



Lodz University of Technology

Poland 

The past 5 years have been very intense at TUL, as far as design thinking teaching is concerned. The DT establishment has moved from thematic workshop organized at the Faculty of Electrical, Electronic, Computer and Control Engineering of TUL in 2010 to more systematic teaching after staff training at Stanford University during the Polish Top500 program. A direct outcome of such training that covered years 2012-2014 is the opening of the DT4U class room that is fully dedicated to DT teaching and team project organization. Nowadays, 30 DT hours have been programmed during the 1st year study at the Faculty of Mechanics since 2014 and recently this has been extended to other faculties thanks to the DiamonDT project. Moreover, courses have also been introduced at the International Faculty of Engineering (IFE) of TUL, to use DT as a methodology applied to



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Norway 

Design Thinking in Tromsø started with a Mexican design thinker called Federico Lozano, who after graduating from Stanford University and working for several years with

UiT / THE ARCTIC UNIVERSITY OF NORWAY

design thinking, got a teaching job in Norway after moving there with his Norwegian wife. The Lab for Design Thinkers was born a year later after initiative from Mr. Lozano, together with a group of students willing to contribute to building a design thinking community on the side of their studies. The DT Lab has since evolved into a hub who has a dedicated place for workshops and teaching, two full-time employees and three official design thinking courses that are taught at the university to more than 100 students annually. Just recently, the DT Lab landed almost 1 million euros in financing from the regional municipality and university to expand their efforts over the next three years.

Spain 

UniversidadeVigo

In September 2014 Design Thinking was introduced at University of Vigo as the working methodology in the master's degree course "Telecommunications Engineering within the Information Society" in order to transmit students the direct link between Engineering and Society, and how Engineering projects interact to different social agents. Engineering practice focused on the person, on actual people, was and is a key concept at University of Vigo. In 2016, the University of Vigo established a framework for the development of teaching innovation groups, and the DESIRE ("Design Thinking Innovation and Research") group was among the first groups to be founded. The University of Vigo aims at pushing innovation in teaching methodology, and they understood that Design Thinking

would contribute to this strategy. Since then, activities pursuing the introduction of the DT methodology are regularly organized, including a yearly 20-hour workshop in the Teachers' Long-Life Training Programme, and several workshops targeted to a general university audience under the support of the Vice-Rector of International Relations and University Extension.



Uniwersytet Technologiczno-Przyrodniczy
im. Jana i Jędrzeja Śniadeckich w Bydgoszczy



SHOPA

Poland 

The story of SHOPA starts well before October 2013, when the project officially started. The desire to move a piece of Silicon Valley to Poland was born while Piotr Szewczykowski was participating in the first edition of the Top 500 Innovators Program in 2011. Piotr spent over two months at Stanford University where he touched design thinking. A year later, Radosław Ratajczak also had the opportunity to participate in the same program at the same university. It was this program, a similar way of thinking, enthusiasm, and simply the mere friendship that had developed between them led to the founding of SHOPA. In January 2013 we began to combine how to transfer to Bydgoszcz what we saw and learned in the Silicon Valley. The opportunity came very quickly, because at the beginning of the year another recruitment to the Human Capital Operational Programme in the Kujawsko-Pomorskie Voivodship was announced. We decided to write something that we want to pursue for the next two years, and not to bother with something we do not believe in. We played bravely but paid off. Our project was ranked first in the ranking list. We started to carry out projects in the design thinking methodology for companies and institutions, and co-operate on the principle of strategic consulting, creating a SHOPA Labs. We create solutions that customers expect. We are dedicated to training in the methodology of design thinking, carry on educational projects based on design thinking, courses and workshops, we are also teaching students. We teach how to use creativity and listen to people. We organize POLISHOPA - an annual, international, and Polish largest conference on design thinking and service design topics, organized since 2014. We gather in one place people who want to develop themselves and their institutions.

Diamond **DT** journey

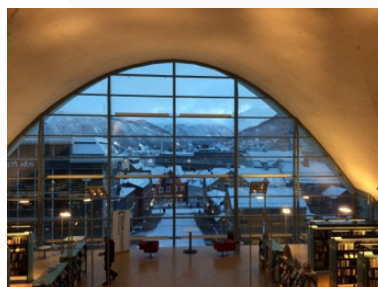
October 2015 **KICK-OFF MEETING** **ŁÓDŹ**

A EU project always starts with organizational tasks. But also a great opportunity to know better each other!



February 2016 **MASTER CLASS** **TROMSØ**

25 design thinkers sharing ideas, experience and concerns about DT teaching during 1 workshop week.



Diamond **DT** journey

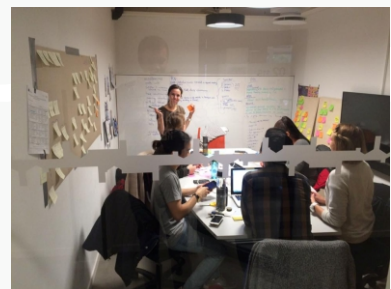
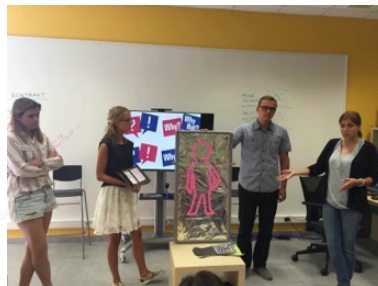
June 2016 **TRAINING FOR TEACHERS** **ŁÓDŹ, VIGO**

A big action of the project: training local teachers. Vigo and Lodz ran a workshop week to deliver their DT knowledge and train new DT ambassadors.



August - September 2016 **NATIONAL GOOD PRACTICE ACADEMY** **ALL PARTNERS**

Four 2-week summer schools at the four partners running at the same time the same DT workshop and challenge



Diamond journey

September 2016

PROJECT MID TERM MEETING

VIGO

A year already passed by. Time to summarize hard work and plan events to come.



November 2016

TEXTBOOK & TOOLBOX

The two first main outcomes of the project: practical guides to implement DT à la sauce DiamondDT!

Diamond 

Design Thinking

TEXTBOOK

Diamond 

Design Thinking

TOOLBOX

Diamond **DT** journey

June 2017

INTERNATIONAL GOOD PRACTICE ACADEMY VIGO

The essence of intercultural and transdisciplinary teams came true during this DT summer school. Fun, hard work and great prototypes!



October 2017

FINAL CONFERENCE ŁÓDŹ

Every great things have an end. This final conference was the best way to sum up the project, but also, for one last time, apply the DT methodology during a creative night!



Tips for Teachers

"The mediocre teacher tells. The good teacher explains. The superior teacher demonstrates. The great teacher inspires."
William Arthur Ward

1. What should teachers pay attention to during DT courses?



DT courses are symbolized by learning-by-doing actions rather than conventional courses where students listened for hours to what teacher says without proactive participation.

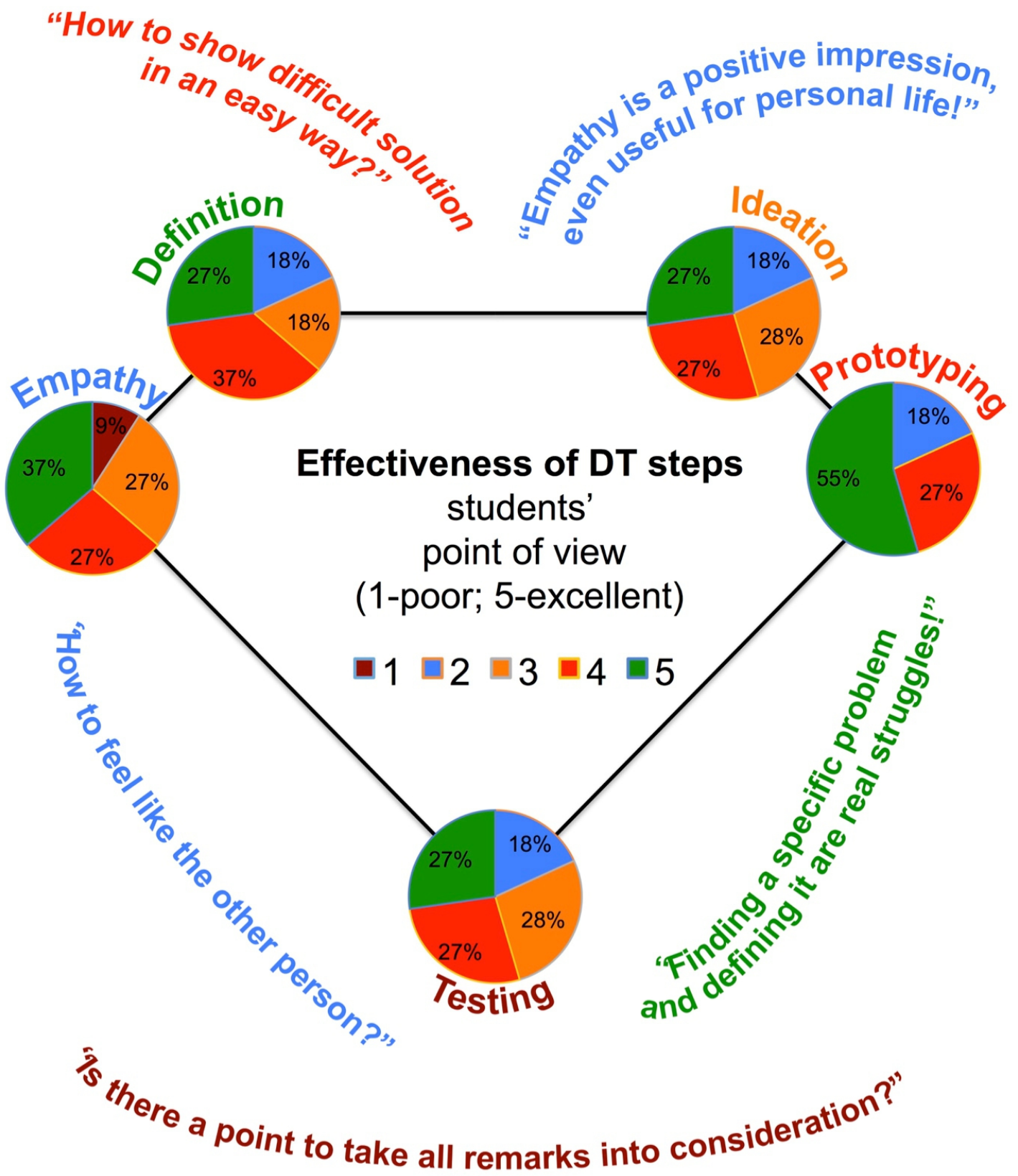
Surveys have for instance pointed out that students are very keen in discovering the potential of DT to solve problems via the presentation of success stories and business-based examples. Indeed, a bit like Doubting Thomas, they only believe what they see rather than what they hear. Examples such as Embrace success story [\[ref\]](#) is usually used to illustrate the potential of Design Thinking. Illustrative examples should be presented during the first DT courses, where an overall glimpse of the process is experienced by students (during DiamonDT, we have called the first course the DT snapshot).

Empathy is central to the Design thinking or more generally human-centered design. However, there have been numerous cases where students haven't deeply immersed themselves in user understanding, privileging for instance online questionnaire than real interview with targeted stakeholders. This has also been revealed by questionnaires, which have shown that students do not genuinely know how to feel like others. Moreover, they rarely use immersion or active observation to feel in the shoes of users. Mentors should therefore arrange practical exer



cises to emphasize this aspect, for instance by proposing topics such as "to feel like a visually-impaired person" or "go back to childhood". In the former case, activities using white cane in a specific action setting (for instance finding his/her way towards building exit) can be a useful help for students so as to realize the need of immersion and empathy with their main target user world.

Surveys have revealed that students evenly enjoy all DT steps. However, the second and third steps, i.e. Define and Ideation, are those where more difficulties are encountered (see diagram below). For instance, the problem quest or Point Of View definition is not seen as an easy task and students have the tendency to scamp it. Similarly, brainstorming sessions during Ideate step demands decision to select best idea between proposed solutions. Survey has revealed that students have trouble to select criteria or rules for selecting it. Therefore, besides carefully monitoring brainstorming session either during courses or teamwork, selection tool based on the 2x2 comparison is a good option to help decision making. Alas, the choice of criterion is never so obvious for students and discussion with mentors should take place so as to decide in a team what are the criteria the most important for the project (and the users' requirements), e.g.: the price, the enjoyability of the solution, innovative aspect, environmentally friendly?



Last but not least, rarely testing after prototyping is done. In many project, teams think that prototyping is the achievement to be reached and therefore often forget the main role of it: getting again users' feedback for future product iteration. Secondly, when testing, they often forget the main rule: to keep silent when the user interacts with the prototype. Indeed, it is commonly assumed that the user receives the prototype with little information and should, by

guess and manipulation, give his/her feedback. Only then the DTers should reenter into a discovery mode to ask questions about feelings, emotions and more importantly constructive criticism for further development/improvement. Mentors should remind students frequently about testing importance and also push students to make it thoroughly. Not keep it as the last thing to do during the last project day.

2. How to make sure teams stay on track: the necessity of frequent evaluation?



It is extremely common that students carry out a project in parallel to the DT courses, as a hands-on experience to apply the methodology and solve problems for targeted users. A constant evaluation of the project progress is therefore necessary and can take different faces.

The first type of evaluation takes, of course, place during regular meeting, where one can judge how the project evolves and how team work together. The role of the supervisor can be two fold: passive or active. When passive, he basically observes the team in action and evaluate how communication occurs and work is organized within the team. Then, he gives his feedback at the end of the meeting. When active, the supervisor asks questions, always trying to be in a discovery attitude. Supervisors can also have an active attitude by participating to brainstorming sessions, for instance by becoming facilitator. Indeed, it is a crucial role in a brainstorming session that the supervisor can take, in order to check that the basic brainstorming rules are respected, e.g. time checking, defer judgment and brainstorming topic proposition. In such a way, he will become a privileged observer of the way discussions take place in the team.

We have often seen that students struggle to define problems and explain them in a clear manner that reflects their finding and also clearly correlates with their research and empathy finding. It is crucial that at the beginning, students are forced to report their progress and future working plans. This can be easily done at the end of sessions, by writing minutes. Also, proposing to the team to sketch a Gantt chart is advised so as to control their work. Moreover, milestone presentations can be done so as to both train their communication skills and check



the consistency of their work, as propose below.

Ways of communicating progress and results:

pecha kucha, speed geeking, poster.

Presentation timing and frequency:

this depends but may be consider 3 to 4 good times spread during the project duration. Here we take the example of a project lasting 15 weeks.

First, we propose to force students to present to the audience the project context and associated main users (after maximum 3 weeks of work). This can be done using Pecha Kucha. Second presentation, sometime called mid-term presentation (so occurring after 6-7 weeks), is usually intended to present POV, which concludes the problem domain. Here, we can judge if problem fits to topic context, if discovery/empathy phase has been done thoroughly. Then, one should propose to students to organize workshop ending first prototype iteration so as to give the users but also external audience the possibility to give feedback. Speed Geeking is a good option here because a variety of persons can deliver valuable criticisms and concerns to the team. But teams can also decide to organize them on their own. Finally, it is a standard practice to finish the project with a presentation. Here, also two options are quite popular. A standard 15-20 minutes presentation is usually chosen, but with emphasis on solution and discussions regarding testing feedback rather than problem that should have been presented earlier. Another way is to set a poster exhibition where, again teams can reach a wider audience than just a jury, which is usually composed by mentors and invited users when possible. In the case of a shorter

project that will last typically 2 weeks (e.g. during summer school), at least two presentations should be envisioned, that is mid-term and final presentation.

Another aspect of evaluation concerns marking. During DiamonDT, two forms of evaluation have been considered: rubric evaluation, where each aspect or item of DT phase is evaluated for a whole team, either by a jury or directly by supervisor. The second mark concerns peer assessment, where students are asked to mark their teammates from different angles related to DT and teamwork. Alternatively, engagement during DT courses can be another mark component if it took place during the curriculum. But there is a debate about evaluation and some teachers encourage when possible to use the PASS/FAIL option. This drastically simplifies the marking, still keeping it as much objective as possible.

References



www.pechakucha.org



www.kstoolkit.org/Speed+geeking



[Team presentation](#)



[Templates for evaluation](#)

3. The different formats of design thinking teaching. Know your audience and adapt to the situation

Design thinking teaching can come in many different shapes and formats, depending on who your target audience is and how much time you have available. In this section we will explore three different formats of DT teaching, and discuss for who these different formats fits the best. Hopefully this will bring you closer to determining the best format for you!

Design thinking in one day

Teaching the methodology of design thinking in one day is difficult, but it can be a great opportunity to spark interest in people who have not previously experienced anything related to DT. We usually call these one-day workshops for “DT snapshot,” “DT in a

nutshell” or “Deep Dives”, as we “dive” straight into design thinking right from the get-go. These workshops tend to focus a lot on examples of design thinking, the creative and open-minded mindset necessary in executing good DT projects, and less so on the nitty gritty definitions of the different parts of the methodology. As an example, you should not spend too much time talking about defining point-of-views (POV) etc, but more so on the empathic view a true design thinker will take. One-day workshops fits great to spark interest in the business community and to recruit students to attend later courses on the subject.

Design thinking in one week

You can accomplish a lot by having a week of design thinking. In fact, two of the three design thinking courses that are taught at the DT Lab in Tromsø consists of a “design thinking intro week” in the very beginning of the semester. During this time, they hold 5-6 “DT sessions” of two hours each to non-experienced DT students, where the process is introduced step-by-step. Unlike the design thinking in one day described above, they here have the opportunity to dive further into examples and stories, and after the first intro sessions that usually take place during the first two days, they end the week with a “design challenge” where students themselves get to apply the learning into one real problem. This design challenge can last anywhere from 3 days to one full week, depending on time constraint. The week ends with students presenting their short but still very often impressive DT projects. Design thinking in one week is a great fit for design thinking as a module as part of a bigger course, or as a stand-alone short DT course for members of the business community.

Design thinking in a semester

If you as a teacher have a full semester course at your disposal and are looking to fill it up with DT teaching you are in a great situation! Having this much time available opens up to many more opportunities to make impactful, “real” DT projects that would otherwise be difficult to handle. At UiT in Tromsø or Lodz University of Technology some courses runs over multiple months, and usually consist of students that have been exposed to design thinking in smaller formats before. Therefore, in this course, it is common to link the course up with the local business community, where students get to work on implementing design thinking on real problems, for real people and companies. If you have a full semester available, we definitely encourage you to spend the

first week or two “teaching” the students design thinking and make sure that they are on the same page. Then, once the first DT intro part is completed, let them go out into the world, have them work with a real design thinking project over time, and spend as much time as you can mentoring the students along the way. Design thinking in a semester fits great for students, or for larger scale business programs.

4. Groups: the endless discussion of group size

Design Thinking is a process in which a group of people work together in interdisciplinary teams. Interdisciplinary is the key word here since each person has a unique set of skills and knowledge. Preparation for teamwork involves: collecting data on the needs and interests of the team, identifying the most important people as seen from the standpoint of the team and gaining their support, creating

an environment of trust and bond in the team through friendly and open interpersonal communication and openness to differences of opinion or stance, analyzing the expectations of possible effects of action the existing risks, determining the conditions and attitudes necessary for commencing teamwork, determining work techniques that can be applied. The size of the group undoubtedly has an impact on the entire behavior of their members. Smaller groups tend to solve problems faster than larger ones, whereas the latter are better at handling tasks. Groups made up of 11-19 members are well-suited to gathering information. As far as learning facts, larger groups prove more effective, but at the same time they are worse at making use of collected information. The most effective action-takers are generally groups made up of 7 people, with larger groups demonstrating problems with consistency, commitment and mutual responsibility. Members of small groups stimulate each other in terms of thinking and an idea generated by one person can inspire the other members.

Determinant	Factors influencing team performance	Consequences for team performance
Team building	Diversity of team members	- positive effect with differentiated knowledge level, seniority and experience, - no recorded positive effect of nationality, age and gender, - homogenous teams are not recommended
	Team size	- negative effect on performance with very large teams; will cause diffusion of responsibility, problems with coordination and division of tasks, - maximum size is 25 people
	Teamwork training	- negative effect when no such training exists and it is assumed that everyone can do it
	Team cohesion	- if too high, degree of cohesion may affect work performance, e.g. lead to decreased work productivity if the group considers it better for their interest

Determinant	Factors influencing team performance	Consequences for team performance
Team tasks	Difficult goals	- increased performance through setting goals that involve the entire team; goals must be feasible, otherwise the effect can be reversed
	Tasks adjusted to team's potential	- expectations from team members impact their performance; members may be perceived as having high potential and high scores (Pygmalion effect) or high potential but low scores (Golem effect)
	Acceptable way of working	- positive impact on the effectiveness of the agreed matters relating to meetings, discussions and work schedules
Individual potential	Personality	- differences in conscientiousness among team members may lead to decreased performance, - performance increases alongside agreeableness, extraversion and openness to experience among team members
	Having complementary skills	- positive impact on the effectiveness of the agreed matters relating to meetings, discussions and work schedules
Individual relationships	Information properties	- linking experience with performance, evaluation of the innovativeness of teamwork effects
	Individual responsibilities toward the team	- increased performance through functional experience with performance, especially in the evolution of the innovativeness of teamwork effects
	Building joint responsibility	- increased performance through engaging the members in work and action

5. Team building: do teams form easily?

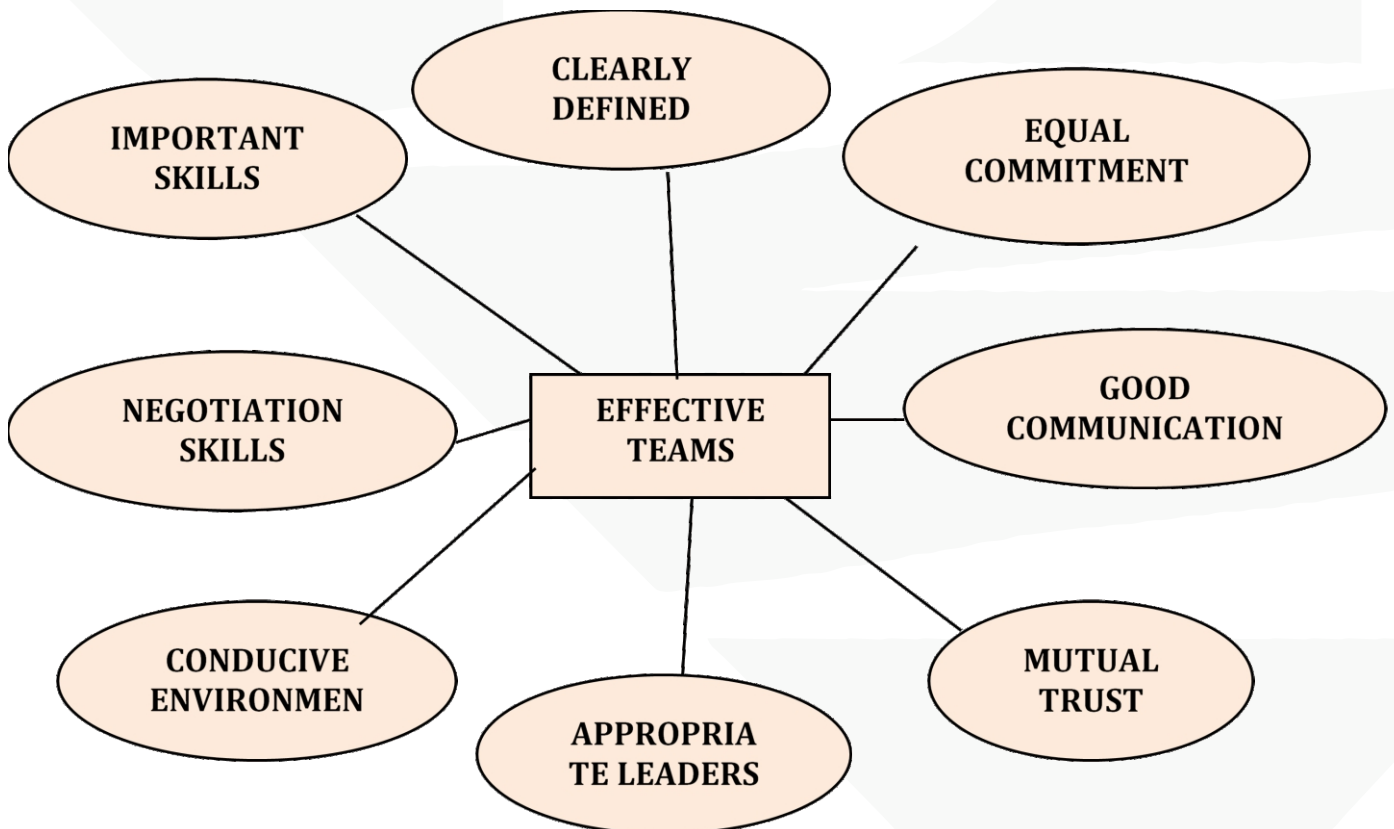
Team building is a gradual process, and it involves finding the identity of the team as well as pinpointing common goals and a shared vision of action. It is also necessary to establish rules for cooperation and define roles and individual goals to be achieved. Maintaining team cohesion requires the continuous updating of the common objectives and the team's mission. Team members must be provided with information regarding the implementation of goals and they need to be reminded of the goals that have been achieved so far. Team members are then able to complement each other. There are four stages of team building:

- **Formation:** excitement level is high; everything is new and interesting; no one is yet fully aware of their role in the team, etc.
- **Storm period:** roles are determined to be met by individual team members; personalities are revealed; uncertainty toward certain people and their skills can lead to a devastating conflict unless it is immediately mitigated; members still do not feel comfortable enough to openly and honestly discuss certain matters.
- **Normalization:** self-confidence of individual team members increases; ties between col-

leagues become stronger; difference of opinion is respected; search for constructive solutions begins; goals no longer seem so distant and everyone starts working together toward their achievement.

- **Proper work:** team operates smoothly and individual members interchangeably guide the team's work; task delegation appears so that everyone has a chance to develop and demonstrate their full potential; goals and tasks are carried out in an effective manner and in accordance with the plan.

An additional element during the building and managing of the team are group games, or team games. Thanks to such games, team members are forced to intensive cooperation in achieving a common goal and getting ahead of the competition. The common objective of these games and activities is to improve communication between members of the group, establish new relationships and subsequently build a team that is effective in terms of acting and achieving goals. The motivation for such actions may be the willingness to test oneself in a new role, a better understanding of one's character traits, discovering new abilities etc. Figure 1 shows the characteristics of an effective team.



6. Supervisor/mentor/tutor/leader: what is the teacher's main role?

Related to the role of the teacher during the development of DT training sessions there are two main issues to take into account. The first one is related to the strong focus on “learning by doing”. The learner doesn't learn by heart in anyway, but through experience, both personal and from third persons, realizing that what it is being proposed is true, real and works in practice. The second one is about the involvement of more than one teacher during the training sessions. In our case, usually two of us act as teachers, one acting more as an instructor that introduces the topics and provides instructions and the other one as a supporting tutor that gives assistance and helps to reinforce the main ideas. He also provides additional experiences and has a clearer view of the classroom atmosphere. that complement and provide different views and experiences about the contents.

From these two premises, it is important to consider the different facets involved in the role of teachers while teaching and training about DT. These different roles can be experienced in a progressive way while the training evolves from the first sessions towards the end of the training:

- First of all, DT teachers usually act as lecturers, offering the topics to be learn and proposing activities to the classroom. Nevertheless, even in this role, the teacher is usually not acting as a regular lecturer, but mainly as an experienced person that has a certain knowledge and is convinced about the benefits of the method. In some way, the teaching acts as a leader, trying to inspire and motivate to the students. He also introduces the different stages and techniques involved in the DT methodology, and specially shows and reinforces the key ideas, such as empathy, testing or feedback.
- The teacher also usually acts as a tutor, providing assistance to students on the performance of tasks and trying to help those that are struggling in. To a long extend, the tutor exists to serve the wishes of the students on the performance of their tasks. Nevertheless, in no way, the tutor is the principal actor, but a secondary one. The tutor lets the students to work by themselves, to carry out the proposed tasks, to decide about the resulting outcomes, etc. As a tutor, the teacher

- just acts when the students are blocked or when they ask for support.
- In general, a mentor is a person with experience in a certain topic that guides a less experienced person by offering indications from the personal experience and expertise. In DT training, the teacher acting in this role does neither offer the good answers nor provide direct instructions, but listens and inquiries the learners in order to get the actions and answers out from themselves. From a teaching point of view, this mentor role is aligned with the goal of empowering the learners as DT researchers that are able to proceed with the process on their own foot.
- The teachers may also act as simple supervisors of what is happening during the DT training sessions. In this role, teachers are almost invisible, they just go around the classroom making observations about what the students are doing, but without taking part or providing any feedback. Most of the time, if students are working in a right way, teachers will be acting of this way, collecting data, sentences and observations (e.g. pictures). All these elements are very useful to be shared later with the students. Usually, at the end of the day, all the teachers and students make a circle around and talk about the whole day, sharing and reflecting the main lessons and experiences. The annotations of the teacher as an observer are very powerful at this point to reinforce and empower the students themselves as real design thinkers.

7. Interdisciplinary teams – a creative value or institutional nightmare?

Everyone working with innovation, creativity or specifically design thinking will know the saying that interdisciplinary teams, meaning teams or groups of people with different education/professions, will lead to better and more creative outcomes. In this section, we will share our experience from this and raise some important questions along the way.

Creative value of interdisciplinary teams

While there are challenges related to interdisciplinary teamwork, including group dynamics, very different opinions between people, insecurity and more, we believe that interdisciplinary teams have a greater potential in DT projects, than the teams made up of too many similar type of people. As an

example: If you put together a group of business school students, they will attack the problem in a very similar way. They will think back to their previous courses, and try to understand the challenge in the way they have been taught. While these students won't do a bad job at all, there would however be more value in the exploration face of there was students in the team looking at the challenge from a "engineering mindset", or a "programming mindset" as well.

Furthermore, once you reach the prototyping and testing phase of your DT projects, the more clear it becomes that groups made up of students only from, in this case, the business schools, will have a harder time scaling up and creating good prototypes, especially if their ideas revolve around anything technical (which often is the case). Opposite wise, groups of engineers only will often struggle more on the "human" aspect of design thinking, which of course is just as important. Finding a good balance within your teams, therefore, is important.

Institutional challenges

While having interdisciplinary teams makes sense for the creative process, it is not always that easy to make happen due to institutional structures at your university. Are you, for example, a teacher at the faculty of Arts and want to start teaching design thinking with interdisciplinary teams? How do you get access to students from other faculties? How to you recruit these students and spark enough interest that they will sign up for your course? Will the course even be relevant to their original study program? These are all relevant questions that you must consider. Below we share some experiences as to how you can overcome these challenges:

- **Do research:** Go to your universities webpages and look at the structures of different programs. Are there particular programs or degrees that have "open courses" that you could fill in with Design Thinking and/or recruit students from? In Norway, for instance, most bachelor programs have 30 or 60 open ECTS credit points that students can use on anything, no matter which faculty or study program they come from.
- **Host a DT workshop:** Use this to spark interest. Invite students from all faculties to attend a one-day (or even less) workshop to spark their interest on design thinking. Make it fun, show cool examples and emphasize how attending a full DT course will be helpful for them, no matter which faculty they represent. The University of Tromsø, had once a business school project related to

- biotechnology. In need of biotech competence in the project, they hosted a pizza / DT workshop session for all biotech students on the master level, in order to recruit them to the following class.

8. DT and engineering: How does it fit?



Interview about nanotechnology and DT

Engineering is a complex discipline that involves many different techniques and approaches towards the creation and making of technical systems bringing to life ideas to solve problems. In many cases, engineering problems are very well-defined by technical descriptions and constraints, such as the construction of a bridge or a communication network. Nevertheless, in many other cases, problems involve key personal issues, and also social and environmental. Nowadays, engineers are not just required to provide solutions under the certainty of precise and clear technical specifications, but also to offer answers to ill-defined problems admitting different approaches and solutions. This requires a good amount of design knowledge and skills, particularly of human-oriented design ones.

In the previous terms, human-centered design and design thinking are widely considered as a central part of engineering nowadays. The application of design principles and methodologies is key in order to develop complex engineering products and large-scale systems. Design provides guidelines on how to approach projects and about how to solve common problems, coping with complexity and with other issues such as environmental and social impacts. Skills such as the reasoning about uncertainty, the making of estimations, the production of prototypes or the conduction of experiments are important for engineering and can be supported by the application of good design principles, particularly well-aligned with the DT methodology. To a certain extent, design assumes a parallel role in engineering as does inquiry in science.

The most common pedagogical model for teaching design in engineering is Project-based Learning (PBL) and DT can be seen as a very appropriate option to guide and orient it. In the context of engineering education capstone projects, performed at

the last year of the engineering studies, have play main role in engineering curricula, because in them the students demonstrate the knowledge, skills and competences required to perform engineering projects. These projects evolved over the years from “made up” projects devised by faculty to industry-sponsored projects where companies provide “real” problems, along with expertise and financial support [REF-1]. At this point DT also is called to play a main role, because it puts the focus on the real problems of people and on the study of the specific needs of particular persons or user profiles.

DT is particularly well aligned with new agile and lean methodologies that are being adopted massively in software and industrial engineering. The agile methodologies are focused towards the client, involving the final user as a main role inside the development team. The engineering work is approached through short interactions to produce reduced versions of the final product, namely prototypes, that can be tested by the final user and provide feedback to the development team. In some way, when the project is initiated it is assumed that it is impossible to have a clear knowledge about what is the solution that should be provided. Therefore, instead trying to define the solution as clear as possible in the first stages of the project, the idea is to develop a first version of the system as soon as possible and to let the final user to experiment it to get his feedback and continue working. In some way, the design emerges from the development process itself, but there is no complete design before the development. The design thinking methodology put a lot of effort on the empathy and definition stages, but its iterative nature also stresses the importance of learning from the development of prototypes and the experimentation with final users.

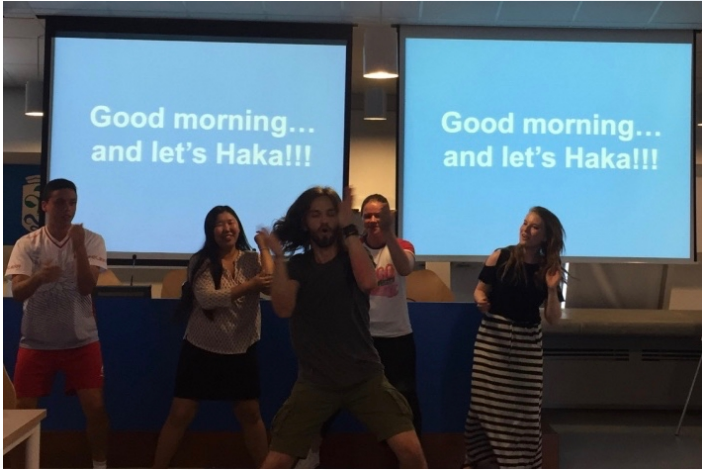
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Tips for Students

*"So often you find that the students
you are trying to inspire are the ones
that end up inspiring you"*
Sean Junkins



1. Perceptions about Design Thinking

The next paragraphs discuss the results of the surveys carried out with students participating in the educational initiatives of DiamonDT around Europe. These surveys were intended to capture the perceptions of students with respect to the applicability of design thinking to real problems and its utility to face real world situations. Besides, we wanted to find out if design thinking was easy or difficult to learn, that is, the perceived cost of acquiring design thinking competences and skills.

Design thinking was generally perceived as a novel approach, as something different to mainstream techniques to face problem solving. It helps to promote creative confidence, to get away from the "strict" and "narrow-minded" ways of facing problems and their solutions. After completing the educational experience, students understand that the design thinking methodology can be applied to complex situations beyond the design of new artefacts or services, involving a community of interacting users with different visions and requirements.

As a side contribution, the courses demonstrate that the design thinking methodology is most appropriate to address problems requiring a user-centred approach by ad-hoc multidisciplinary teams, as it dramatically facilitates group building and coordination among solution designers with different

backgrounds and expectations. Incidentally, students explicitly value the participation in multidisciplinary teams. Indeed, design thinking can play the role of a cross-disciplinary methodology, which allows a team across disciplines to develop a shared understanding of problems and solutions, as it broadens disciplinary reasoning and helps to forget about established internalized along their university studies.

Skills developed by design thinking include working with people and in teams; being creative and innovative in the workplace, confidence, presentation skills, analytical thinking, and dealing with difficult people by putting into practice soft skills such as empathy, active listening, positive orientation, etc. Students become especially aware of user orientation and, related to this, the importance of empathy to understand the needs of real users. However, in some cases it was difficult for students to understand that interpreting the needs of users is not just about deducing, but also included a relevant amount of sense making.

Students also had some difficulties with their full integration in multidisciplinary teams. One of the design thinking aspects that was more difficult to transmit to the students is that "the team is greater than the sums of individuals".

Experience also demonstrated that it is not easy to overcome a strong attachment to the solution

chosen (i.e., it is hard to go back and discard some solution that seems to work but is far from the being the most convenient solution from a design thinking perspective).

Although courses offered in the framework of DiamondDT project were in general perceived as useful and positive, in a limited number of cases the course did not meet the students' expectations, being in most cases engineering students the ones having this perception. The main reason for this seems to be that problem-solving approaches in design (i.e., the seminal field of application of design thinking) are different from that in engineering. Whereas design thinking allows dealing with the ambiguity of design problems as wicked problems, the mental processes of engineering students is typically more biased to the development of effective technical solutions. In the case of problem-based-learning projects in engineering, the difficulties in communication between experts (i.e., engineering students) and non-experts (i.e., final users) during the engineering development process made the blend of both approaches complicated and lead to a dominance of analytic-systematic approaches to problem and solution finding.

It was also possible to observe a trend to perceive design thinking as something difficult to apply within existing organizational structures in companies and organizations, no matter that it is generally appealing to developers when it is communicated during courses and other educational initiatives.

Related to this, a kind of risk perception can also be identified. For example, developers, designers and practitioners accustomed to standard procedures in engineering, economics or science see as a real challenge to match existing performance or outcome indicators and project milestones with the empathy-based and explorative paths of design thinking. In other words, design thinking is in some cases perceived as a fuzzy, unclear approach to project development that may help to think out of the box, but also may compromise communication of results and justification to customers and other stakeholders.

One approach to face the situation above could be to identify specific tools to assist the developer in implementing design thinking, to make them to identify design thinking with an adaptive toolbox including tools that can be applied depending on what kind of problem they face along the development process. This would make design thinking more flexible, becoming something that can be applied on demand and in a gradual way.

2. Employers' expectations

The next paragraphs discuss competences of prospective graduate (i.e., to-be-employees) that would provide a competitive advantage when seeking quality employment.

According to many companies, it is an out-dated approach to focus on professions that may be popular in the future. Rather we should concentrate on competences. The analysis of the material gathered during interviews with various employers in Europe as well as other commercially available data indicates that for most professional categories employees put special emphasis on self-organisation skills. The exception is people working in the service industry who should have good interpersonal skills to ensure good customer experience. Specialists and engineers should have good social competence. These skills have particular significance as they are hard to learn or acquire and it takes a long time to do so.

Employers are aware that employees will need to undergo training of the so-called "hard skills" required by the specification of the workplace or position. Research clearly shows that professional competences are important in the case of managers, labourers, operators or assemblers and less important for office workers or specialists. An in-depth analysis of employers' recommendations and job offers made it possible to identify detailed interpersonal and self-organisation competences important for particular professional categories. Managers, regardless of professional category, should have good communication skills, show their initiative, be independent and good at time management and be able to work in a team. As for people working in the service industry additional emphasis is put on ease in establishing and maintaining good contact and relationship with the customer. Specialists should have good communication skills, be independent and have good time-management skills. Teamwork and pro-activeness were also stressed here. Being pro-active is also required from office workers and technicians besides independence and good time-management skills. People employed in the service industry should have good communication skills, be pro-active and sellers ought to additionally have ease in establishing contact with the customer. In the case of labourers, qualified or unqualified, assemblers or machine operators' interpersonal competences are much less important. They should have self-organisation skills such as pro-activeness

and a taste for entrepreneurship. In these professions, professional competences are the most important and often certificates shall confirm them. To sum up, on the basis of the data gathered ten such competences were selected:

- ☞ 1. The ability to extract hidden meanings, interpretation of hidden content, understanding of facts so important in the process of decision making
- ☞ 2. Ability to communicate with others on emotional level, social intelligence
- ☞ 3. Ability to think and come up with solutions which are not governed by strictly defined rules: reaction to non-standard situations, using creativity
- ☞ 4. Ability to work in various environments, the so-called „multicultural competence“. The best team is a team whose members vary in age, skills, way of thinking and working. It generates many outcomes and facilitates detailed assessment of possible solutions which helps in choosing the best one.
- ☞ 5. Ability to process big portions of data into abstract concepts and understand proofs depending on this information, the so-called “analytical thinking”. Sought after are people capable of performing statistical and quantitative analyses as the body of available data is ever growing.
- ☞ 6. Ability to understand and read various forms of information, video or picture and being able to analyse them and interpret. Needed are people who are skilled in reading and creating these types of messages, capable of communicating one's work results not only in the form of documents or presentations, but also video.
- ☞ 7. Understanding concepts which span multiple disciplines, that is, interdisciplinary competence. Sought after are employees who have a specialised knowledge in one particular field complemented by general knowledge from other fields necessary to solve a complicated problem.
- ☞ 8. Ability to develop work's tasks and processes in such a way as to ensure reaching its goals, the so-called project-oriented approach. It also means ability to change the environment of work so that it has a positive effect on project's execution and finalization.
- ☞ 9. Ability to filter out information. Selecting only information important for task completion.
- ☞ 10. Ability to operate with due commitment and

☞ be part of teams regardless of the present location of their members, on-line cooperation.

It can be noticed that the above competences are a response to the changes in the contemporary world. Companies these days operate largely on international markets thus their employees should feel comfortable in international teams. For that the ability to speak foreign languages and use mobile technologies is needed. An employee should be multi-functional, capable of accepting frequent changes to the scope of their responsibilities or even position of work. It is important to be flexible or display willingness to retrain as assigning new tasks to employees is not a rare occurrence in small business particularly but it is true of big companies as well. Knowledge and IT technologies management skills are no less significant.

3. The example experience of the Academic Career Centre

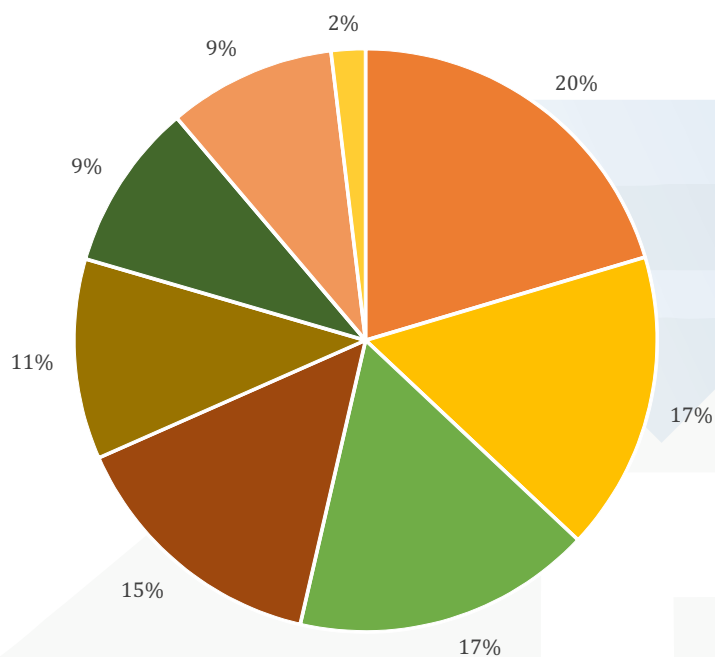
Tracking the graduates' professional development is among the most important goals of the Academic Career Centre. Other recurring aspects of their operation include the organisation of student training, including international students; organisation of job fairs; involvement in ensuring high standards of internal system of training; surveying employers organising student training; surveying employers employing graduates; research into employers' demand for a particular competence; coaching, organising meetings with secondary school students; professional and educational counselling for final year secondary school students; organising workshops on active participation on the job market and entrepreneurship as part of the academic teaching programme; psychological counselling, and setting up an academic business incubator within the career centre.

Cooperation with employers primarily means:

- Sharing offers of jobs and student training.
- Co-hosting branch meetings.
- Presenting companies.
- Agreeing on organisation of voluntary student training by which students can gain necessary experience in a chosen company or institution.
- Co-organizing job fairs.

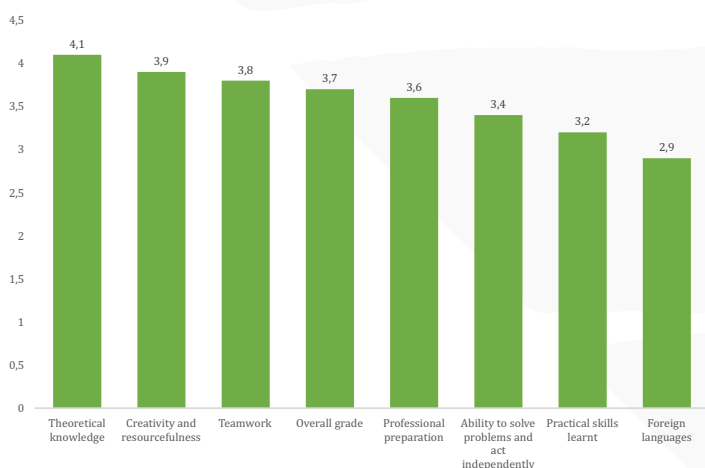
From the surveys carried out among employers emerges a profile of the graduate-employee including factors that are taken into account in recruitment (data obtained from 45 companies at Kujawsko-

Pomorskie and Małopolskie voivodships in Poland):



- Job interview result
- University's prestige
- Other person's recommendations
- Internships, student training organised by the company
- Personal and interpersonal competence
- Intellectual and academic competences
- CV and cover letter
- Diploma and final grade

A graduate's level of professional preparation was also defined (5 – excellent, 4 – good, 3 – sufficient, 2 – poor):



On the basis of the surveys carried out by the Career Centre a list of skills/qualifications that employers found valuable in a technical university graduate was made. The following skills are in the order of importance:

1. Theoretical knowledge
2. Creativity
3. Practical knowledge
4. Teamwork
5. Working to deadlines
6. Proficiency in using multimedia and electronic devices
7. Propriety
8. Good interpersonal skills
9. Loyalty towards employer
10. Independence
11. Ability to work under pressure
12. Availability
13. Foreign languages

4. Learning Design Thinking



Our four institutions are recognized for their expertise in design thinking. However, if you have the willingness to get a DT flavour from other places (real or virtual), here is a selection we can propose to you.

Stanford University Institute of Design (d.school). The cradle of Design Thinking, it offers a portfolio of educational solutions at all levels, including resources for self-teaching, online courses, regular courses, etc.

Especially relevant is the Virtual Crash Course in Design thinking, an online version of one of their most frequently sought after learning tools. The resource provides video, handouts, and facilitation tips, to take the learner step by step through the process of hosting or participating in a 90-minute design challenge. The final aim is to become familiar with some of the basic principles of Design Thinking and start to adapt them into the learner's personal and professional routines.

d.school also provides Design Thinking Artifacts and the popular Bootcamp Bootleg collection among other relevant resources. You can find more information on Stanford University Institute of Design and on educational offer at dschool.stanford.edu.

IDEO U, an online school offering courses to develop learners' creative potential through design thinking and collaboration. IDEO U is part of IDEO, a design firm that takes a human-centered, design-based

approach to helping organizations innovate and grow. IDEO U offers a playful and collaborative online learning experience intended to enable individuals, teams, and communities to see the world differently and solve problems in new ways.

Apart from their online course offer, IDEO U offers a collection of Design Thinking resources both from them and other partners, including a Design Thinking Toolkit, tips related to the different Design Thinking phases, or a collection of case studies.

IDEO U also maintains a community of enrolled learners to share ideas, network, etc.

Finally, you can find below a selection of additional free courses online.

- **[Design Thinking: Innovate in Style](#)** is an online course offered by Udemy targeted primarily to business people, marketers, sales people, entrepreneurs and business developers. The provider claims that this course will help the student to understand how to take a deeper look at what your audience are really after and generate ideas and solutions that are ultimately going to be more fulfilling. Udemy acknowledges that, instead of taking things for granted or repeating solutions that have been seen or done before, a design thinking mindset empowers stakeholders to struggle to innovate and deliver a better experience. Udemy is a global marketplace for learning and teaching online that offers an extensive library of over 45,000 courses in a broad selection of subjects and topics.
- **[Innovation and Design Thinking](#)** is a massive open online course (MOOC) offered by the University of Cincinnati. Participants who successfully complete the course and enroll as a new student at the University of Cincinnati will receive graduate credits that can be applied toward either an MBA degree from the Lindner College of Business or a Master of Engineering degree through the College of Engineering and Applied Science. This course could also serve as an example on how to blend online education with traditional face-to-face teaching to define comprehensive educational paths in innovative topics.
- **[Design Thinking](#)** - this is course, also a MOOC, is offered for free by the Open University through its Open Learn platform. The course develops skills for the students to be aware of how design thinking can be applied in a wide range of contexts, from the personal to the global. It also teaches how to investigate and think creatively about

- design problems and opportunities. Finally, it initiates an attitude of playfulness to aid design thinking develop visual literacy and articulacy to explain design decisions. The course can also be downloaded in different formats (PDF, MS Word, Epub 2, Kindle) to be used offline. Established in 1969, the Open University is the reference university for distance higher education in the United Kingdom. It is the largest university in the UK, where four out of ten part-time undergraduate students pursue a degree from its portfolio.
- **[Design Thinking for Innovation](#)** - is a MOOC on design thinking offered by Coursera. The course provides an overview of design thinking and proposes a model containing key questions and several tools to help students to understand design thinking as a problem-solving approach. The course also analyses several cases from different organizations that used design thinking to uncover compelling solutions. Coursera was founded in 2012 by Stanford Computer Science professors Daphne Koller and Andrew Ng. Since then, Coursera became a platform where anyone, anywhere can learn and earn credentials from around 150 world's top universities and education providers.

You can find below other free e-books and e-manuals:



Karl T. Ulrich. Design: Creation of Artifacts in Society. University of Pennsylvania, 2011.

<http://opim.wharton.upenn.edu/~ulrich/designbook.html>



Coelyen Barry, Mike Davis, Bill Wolf-Tinsman. Design Thinking Workshop. Hathaway Brown School, 2012.

https://www.hb.edu/uploaded/Innovation_Summit/Wolf-TinsmanBarryDavis_DesignThinkingWorkshop.pdf



José Berenguères. The Brown Book of Design Thinking. The University College. UAE University, Al Ain, UAE, 2013.

http://faculty.uaeu.ac.ae/jose/designthinking/design_thinking_course_book.pdf

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www.ds.school.stanford.edu



www.ideo.com



Frequently asked questions about Design Thinking



We think that a FAQs section is very adequate to end this handbook. It reflects questions that we have often heard from students during DT courses and workshops.

GENERAL QUESTIONS

What is the role of the mentor?

The mentor is neither a member of a team nor the teacher. Mentor guides through the process of the project realization. Encourages to work and to follow creative ideas. By storytelling, personal knowledge and case studies, he or she tries to boost both team spirit and flow of ideas during the teamwork. Staying outside the working group mentors keep the distance to the developed solutions but still draw attention of the group to various aspects of their work, show weaknesses but also praise the advantages of the results of their work.

Should the leader of the working group be assigned at the beginning of the project?

There are people who are the “born leaders” - for them dividing and maintaining the teamwork is a natural process. It is always a good idea to use such “assets” as soon as possible. Nevertheless, Design Thinking methodology is based on cooperation and free will to share and evolve ideas of others, though strict supervision and sharp leadership is not the most suitable approach. Rational is swapping the leadership according to the current needs (sometimes stages of the DT process). In that way, each member of a team can be a leader at a point that suits him or her the most.

How much time is scheduled for each stage of work?

There is no strict division of workload among the stages and so there is no exact amount of time devoted to each stage. The most effort must be placed on proper empathy. Observing, interviewing or “deep dive” in the life of target group is probably the most time consuming since collecting knowledge requires time (for making appointments, selecting places to visit, conducting surveys, retrieving data from questionnaires etc.). Other stages of DT require analysis of obtained data and development of new solutions. The idea is to work quickly and iterate if necessary rather to get stuck at any point for more than a week or so.

EMPATHY

Can empathy be simulated? (Students suggest that it is a good idea to do a simulation of Empathy)

No. Information that is required for the sake of Design Thinking process requires interaction with real users and in that way it cannot be simulated. Of course, each aspect of empathy (observe, understand, immerse, etc.) can be practiced via different exercises. For example, to prepare for interviews you can conduct trial conversations with family members or friends. The easiest way to practice empathy is to interact with new people all the time, so start a chat with “stranger” during your meal break or walk to the park.

How to do proper Empathy?

Observe, understand and immerse. For the sake of inference the data is required (the more the better) so YOU have to collect them. To succeed the easiest way is to follow the milestones of proper empathy: interviews (or at least questionnaires), a bit of staring and if possible experiencing the life of “end user”. Do not trust your memory, always write down your observations, try to record the answers, take plenty of photos or record movies etc.. Data in such a form can be more easily correlated with findings of other group members. What is more, any group member will be able to return to them at any time.

Where to go for the interview?

There are no good or bad places for interviewing. Initial interviews can be conducted among wide range of people (different age, sex, hobbies etc.), so the best way is to look for places with diversified visitors e.g. shopping malls, parks, university etc. It is always a good idea to get a contact with interviewed

people because you can involve them in the whole DT process (further interviewing and testing). With time, the target group is getting more narrow and narrow so interviews must be conducted in places where those specific people can be found. It means not only at their workplace but also in places where they spend their free time or even at home. Try to also correlate the spot of interview with the places related with the topic. For example, in the case of “oral hygiene experience”, perfect spots are not only dentist office and toilet/bathroom at home but also cosmetics in department stores, rest rooms at airports etc.

How to initiate and maintain a conversation?

First of all be polite. Always start the conversation with greetings and short description of the reason of that interview. At the beginning ask general questions and with time dig deeper and deeper. Usually people do not want to describe their feelings or harsh personal experiences with complete strangers so make a chat rather than polling. During such conversation flexibility is another key aspect. Do not stick to the prepared questions at any price but follow the most interesting aspect mentioned by the respondent.

DEFINE

What means POV?

POV is the abbreviation of Point of View. It is a compact (usually one or two sentences), synergistic insight into the problem of the specific recipient or group of recipients.

Why so much attention is focused on POV?

POV is a WOW statement since it sums up the key reasons that stands behind working with each project: problem, group of receivers and insight. In that way, it helps to keep track during succeeding steps of DT process and all the iterations since it reminds the group: what they want to solve and improve; for whom they design the solution; what is the key aspect that must be considered.

IDEATE

How many ideas are enough?

There are no strict rules, however the more the ideas, the better. If you feel out of fresh thoughts, don't dwell on it, let go, move forward or do focus on something else. If you come back with a fresh head, surely, you will come up with new solutions. Also, we

usually generate ideas during short brainstorming sessions. So, you can easily accommodate your time to organize few sessions and have breaks between them.

I ran out of new ideas, what should I do?

Discussion among co-workers is the most crucial part of ideation. An important aspect of ideation step is also to build on other ideas. So you may run out of ideas, but hear one that is extremely inspiring for you and you will be able to build on it. It is definitely as valuable as proposing a new idea. Remember, don't criticize, even if concepts seem ridiculous at first. During discussion team members should motivate and encourage each other, hear out all the ideas in full. There will be time for selecting the best ones later.

When to stop Ideation?

Try to perform no more than one or two days long intense session of ideation. It is better to quickly prototype and test the initial solutions and redo the Ideation phase with some new constraints rather than spend months on ideas that in fact cannot be realized.

PROTOTYPE

What materials are the best for prototyping?

Use those materials which will serve best for presenting your solution, do not spend a lot of money for them. Remember, a prototype is not the final product. However, it should demonstrate the idea behind the product in the best possible way. The final user should be able to understand the solution and the way it works by looking, using or interacting with the prototype.

TEST

When the testing should start?

You can start testing when your prototype, or at least a meaningful part of it, is ready. The sooner you test your idea, the less time and money the creation process will consume.

How to collect information after testing?

Remember to describe and demonstrate the functionality of your prototype. Observe and note the testers feedback - not just answers to your questions, but also their reactions. If possible make photos or movie during that step of Design Thinking process.

How to start testing?

Some people have a hard time imagining solutions based on a rough prototype, and then it is your job to



guide them through the experience of testing your prototype. A good option is to describe the situation, surrounding, circumstances of using the prototype. After such introduction, sometimes you might just give the prototype and observe what testers do, while in other situation you might be forced to guide them through the experience of using it. Everything depends on the context. What you are looking at is feedback. And be mentally ready for criticisms.

What questions should be asked during testing?

The best questions are the ones that are general and do not drug the desired answer from the tester. So “How would you use it?” instead of giving right away the detailed “manual”. Replace: “Is it big enough?” with “What about the size? Shape?” Benefit from the point of view and creativity of testers for example by asking: “When would you use it? What do you see not working? Do you see any other areas it could be useful?”

How to react to negative feedback during testing?

If testers criticize you or the prototype that's fine. Do not try to defend your work, but absorb the information, say thank you and move on. There is nothing to gain by arguing why you are right. It is important to understand that the wisdom of the crowd is greater than yours. At the same time, listening to users does not mean that you should do exactly what the users tell. It means listen, reflect and understand what that means. Remember the well-known motto of design thinking: IT'S OK TO FAIL! And this is a thing you may experience during testing!

Diamond

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