



UiT Norges arktiske universitet

Deltakelse i EU-prosjektet DiamonDT

Rapport om utviklingsarbeid (2015-2017)

Skrevet av Håvar Brattli og Alexander Utne, september 2022

Diamon DT



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FORORD

Denne rapporten er skrevet av Håvar Brattli og Alexander Utne ved Handelshøgskolen ved UIT Norges arktiske universitetet. Rapporten gjennomgår vårt bidrag i arbeidet med det EU-finansierte prosjektet «Development of Innovative Academy on the basis of DT Teaching» (DiamonDT) gjennomført i tidsperioden 2015-2017.

Vi ønsker å rette en takk til våre dyktige prosjektpartnere ved Lodz University of Technology, University of Vigo og University of Technology and Life Sciences in Bydgoszcz for arbeidet med DiamonDT og tilhørende aktiviteter.

Tusen takk til Dorota Bocianga, Radoslaw Ratajczak, Mateusz Wirwicki, Magdalena Kowalska, Filip Sieracki, Cezary Graul, Iñigo Cuiñas, Perfecto Mariño, Francisco Diaz, Enrique Costa, Manuel Caeiro, Krzysztof Jastrzebski, Aleksandra Jastrzebska, Dorota Kaminska, Robert Banasiak, Anna Laska, Jacek Nowakowski, Katarzyna Znajdek, Monika Malinowska-Olszowy og Laurent Babout.



Figur 1 Prosjektpartnere fra Lodz, Bydgoszcz og Vigo til stede i DT Lab. UIT / Tromsø. 15 januar 2016. (Eget foto)

Tromsø, september 2022

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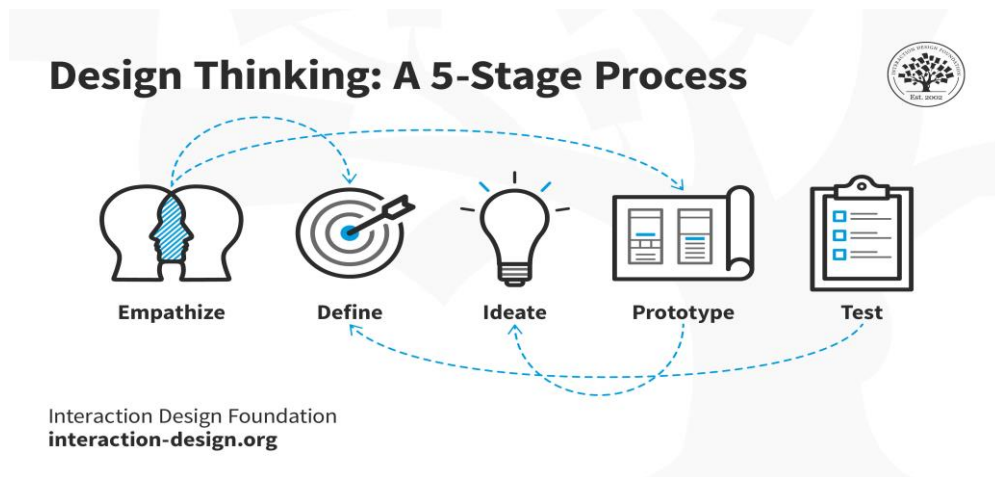
1 Innledning

Denne rapporten omhandler prosjektet «Development of Innovative Academy on the basis of DT Teaching» (DiamonDT). DiamonDT var et samarbeidsprosjekt mellom Lodz University of Technology (Polen), University of Vigo (Spania), University of Technology and Life Sciences in Bydgoszcz (Polen) og vårt eget institutt, Handelshøgskolen (HHT) ved UiT Norges arktiske universitet (UIT). DiamonDT ble finansiert gjennom Europakommisjonens «Erasmus+ KA2 - Cooperation for Innovation and the Exchange of Good Practices Strategic Partnerships for higher education»-program (European Commission, 2017). Det overordnede målet med prosjektet var å utvikle de deltakende universitetenes kompetanse i undervisning av design thinking.

Design thinking er en innovasjonsprosess som kan benyttes til å utvikle produkter, tjenester og prosesser (Tschimmel, 2012). Design thinking-prinsipper benyttes i dag av en rekke av verdens mest innovative bedrifter (Han, 2022), og anerkjente universiteter som Stanford University, Massachusetts Institute of Technology og Harvard University har egne programmer og kurs i metodikken (Kurokawa, 2013). UIT var et av de første universitetene i Norge som utviklet kurs i design thinking. I dag tilbyr en rekke norske universiteter og høyskoler enkeltemner i metoden (NHH, 2022; NTNU, 2022; UIA, 2022).

Design thinking utnytter designeres arbeidsmetoder for å integrere menneskers behov, mulighetene i teknologi og behovene til bedrifter for å oppnå forretningssuksess (Brown, 2009). Metoden søker å finne det ideelle krysningspunktet mellom hva mennesker ønsker (desirable), hva som er teknologisk gjennomførbart (feasible), og hva som er økonomisk levedyktig (viable) (Idea, 2022). Prosessen består overordnet av fem ulike steg, hvor det første steget (Empathize) består av intervjuer og observasjoner av brukere og kunder for å i større grad få innsikt i deres behov. I det neste steget (Define) definerer man disse behovene, før man i det tredje steget (Ideate) kommer opp med nye ideer og løsninger basert på de steg en og to. Det fjerde og femte steget (Prototype og Test) omhandler utvikling av prototyper og tilhørende eksperimenter og tester av disse, som regel rettet mot reelle brukere og kunder i en virkelighetsnær kontekst. En design thinking-prosess er ikke-lineær og iterativ, noe som innebærer at man i en design thinking-prosess ofte vil hoppe fram og tilbake mellom de ulike

stegene (Braha & Reich, 2003), f. eks gjennom å re-definere kundebehov basert på tilbakemeldinger fra kunder i testingen av en prototype. Design thinking-prosessen oppsummeres i figur 2.



Figur 2 Overordnet Design Thinking-prosess. (Interaction Design Foundation, 2022)

Vi ble invitert til å delta i prosjektet av Lodz University of Technology i Polen, som var initiativtaker bak prosjektet og som påtok seg koordineringsansvaret mellom de deltagende universitetene. Bakgrunnen for invitasjonen var at vi gjennom pågående arbeid med prosjektet The Lab for Design Thinkers (DT Lab) ved HHT allerede hadde erfaring i å undervise design thinking, samt å utvikle aktiviteter og tilbud basert på metoden (Brattli & Utne, 2022). Ettersom de deltagende universitetene fra Polen og Spania hadde en betydelig mindre grad av slik erfaring, var vi en kritisk partner i prosjektet.

Vår motivasjon for å delta i DiamonDT var basert på muligheten til å videreutvikle vår egen kompetanse med undervisning av design thinking, samt muligheten til å danne ett nettverk for undervisere av design thinking. Gjennom deltakelse i prosjektet ville vi også kunne få innblikk i hvordan kollegaer fra andre universiteter i Europa arbeidet med utvikling av fagmiljøer i design thinking, noe som kunne inspirere oss i vårt eget arbeid med utviklingen av DT Lab og tilhørende tilbud. Videre er internasjonalt faglig samarbeid en sentral del av UITs strategi (UIT, 2022), og deltakelse i et EU-finansert prosjekt med partnerinstitusjoner fra flere europeiske land, slik som DiamonDT, ville være en gulrot for vårt eget institutt og

fakultet. Til slutt var vi stolte over å ha blitt spesielt utpekt til å delta i prosjektet basert på vår egen erfaring i design thinking, og vi følte på et stort ansvar om å dele av denne erfaringen.

For å oppnå prosjektets hovedmål om å utvikle kompetanse i undervisning av design thinking fikk vi (DT Lab) blant annet ansvar for å utvikle et kurs i *hvordan å undervise design thinking* rettet mot faglige ansatte hos de respektive partneruniversitetene. Kurset ble gjennomført på UIT i januar 2016. Prosjektarbeidet besto videre av utvikling av ulike arbeidspakker, aktiviteter og samlinger utført i tidsperioden 2015-2017. Dette arbeidet inkluderte blant annet møter og erfaringsutveksling, samarbeid om utvikling av kursmateriell og andre støtteressurser for fremtidige undervisere av design thinking, opprettelse av bachelorkurs i design thinking-metodikk ved hvert universitet, samt tilrettelegging for et design thinking *case-arbeid* i Vigo, Spania våren 2017 utført av spanske studenter i samarbeid med tilreisende studenter fra Norge og Polen.

Videre i denne rapporten oppsummerer vi prosjektets målsettinger og målgrupper (kap. 2), samt prosjektorganisering og vårt bidrag i arbeidet (kap. 3). I kap. 4 gir vi en oversikt over prosjektets ulike arbeidspakker og samlinger, og i kap. 5 gjennomgår vi aktivitetene som vi selv hadde overordnet ansvar for. Flere av prosjektets resultater presenteres i kap. 6, mens vi i kap. 7 oppsummerer arbeidet og reflekterer over prosjektets betydning og våre egne erfaringer fra deltakelse i prosjektet.

2 Prosjekt mål

Prosjekts overordnede mål omhandlet utvikling av undervisningskompetanse i design thinking-metodikk ved Lodz University of Technology (Polen), University of Vigo (Spania), University of Technology and Life Sciences in Bydgoszcz (Polen) og UIT (Norge). Delmål 1 og delmål 2 skal bidra til å oppnå prosjektets overordnede mål.

- 1) *“Prepare tutors in the field of design thinking”*
- 2) *“Provide experience in teaching design thinking”*

Målgruppene i prosjektet var faglige ansatte og studenter hos ved de ulike universitetene.

3 Prosjektinformasjon

3.1 Prosjektorganisering

Tabellen (1) under gir en oversikt over deltakende universiteter, prosjektroller og kontaktpersoner i prosjektet DiamonDT.

Tabell 1 - Oversikt over prosjektdeltakere.

	Institusjon	Nettside	Prosjektrolle	Kontaktpersoner
	Lodz University of Technology (Polen)	www.p.lodz.pl	Koordinator	Vise-rector for utdanning Sławomir Wiak OG Førsteamanuensis Dorota Bociąga.
	University of Vigo (Spania)	www.uvigo.es	Partner	Professor Fernández Iglesias Manuel og Eva Garea Oya.
	University of Technology and Life Sciences in Bydgoszcz (Polen)	www.utp.edu.pl	Partner	Professor/rector Antoni Bukaluk og Førsteamanuensis Małgorzata Gotowska.
	UIT Norges Arktiske Universitet (Norge)	www.uit.no	Partner	Fakultetsdirektør Terje Aspen og Universitetslektor Federico Lozano, Håvar Brattli og Alexander Utne.

3.2 Økonomiske rammer

DiamonDT var eksternt finansiert gjennom Europakommisjonens “*Erasmus+ KA2 – Cooperation for Innovation and the Exchange of Good Practices Strategic Partnerships for higher education*”-program”. Prosjektet mottok en samlet finansiering på € 162 376,- EURO, hvorav UITs andel utgjorde € 54 542,- EURO. Prosjektperioden var fra 1.11.2015 til 31.10.2017.

3.3 Vår rolle og prosjektbidrag

Fakultetsdirektør Terje Aspen ved Fakultet for Biovitenskap, fiskeri og økonomi (BFE) ved UIT var prosjektansvarlig for UITs deltakelse i prosjektet. Hovedvekten av UITs bidrag i prosjektet ble utført av Federico Lozano (HHT), Håvar Brattli (HHT) og Alexander Utne (HHT). Brattli og Utne hadde delt prosjektlederansvar for UITs bidrag i prosjektet. Vårt bidrag i prosjektet inkluderte følgende:

- Ansvar for utvikling og gjennomføring av kurs i «hvordan å undervise design thinking» rettet mot faglige ansatte.
- Ansvar for gjennomføring av bachelorkurs i design thinking på UIT.
- Ansvar for rekruttering av studenter til deltakelse på internasjonalt casearbeid.
- Ansvar for undervisning/veiledning under internasjonalt casearbeid i design thinking.
- Bidrag i utviklingen av «Textbook for good practice in teaching and learning the design thinking methodology» (Vedlegg 2).
- Bidrag i utviklingen av «Toolbox» (Vedlegg 3).
- Bidrag i utviklingen av diverse kurs- og undervisningsmateriell i design thinking-metode, samt læringsutbyttebeskrivelser for design thinking-emner.
- Innspill til søknad om finansiering til EU.
- Deltakelse på prosjektmøter og samlinger.
- Div. administrativt arbeid, inkludert budsjettering, reiselogistikk, registrering av timelister og delrapportering.

4 Oversikt over samlinger og arbeidspakker

4.1 Samlinger og kurs

Tabellen (2) under gir en oversikt over samlinger og kurs gjennomført gjennom DiamonDT-prosjektet, samt vårt ansvar relatert til de spesifikke samlingene/kursene.

Tabell 2 - Oversikt over samlinger og kurs i DiamonDT.

	Samling / kurs	Dato	Sted	UITs rolle
	Oppstartsmøte for prosjektet	November, 2015	Lodz	Deltaker
C1	Design thinking-kurs for undervisere / (I prosjektet kalt “ <i>Masterclass</i> ”)	Januar, 2016	Tromsø	Ansvarlig
C2	Lokal trening av undervisere i Design Thinking (« <i>Short-term joint staff training events</i> ”)	Juni 2016	Vigo, Bydgoszcz, Lodz	Ikke deltaker
C3	Design thinking-kurs for bachelorstudenter (“ <i>National good Practice Academy</i> ”)	Mai – August 2016	Tromsø, Vigo, Bydgoszcz, Lodz	Lokalt ansvarlig
C4	Internasjonalt casearbeid i design thinking (« <i>International DT Practice Exchange</i> ”)	Juni, 2017	Vigo	Delt ansvar
E1	Avsluttende prosjektkonferanse	Oktober, 2017	Lodz	Deltaker

4.2 Arbeidspakker

Tabellen (3) under gir en oversikt over arbeidspakker

Tabell 3 - Oversikt over arbeidspakker i DiamonDT-prosjektet.

	Beskrivelse av arbeid	UITs rolle
O1	Opplæringsmateriell for fremtidige lærere i Design Thinking-metodikk.	Bidrag
O2	Kursprogram for design thinking-kurs	Bidrag

O3	Læringsutbyttebeskrivelser for design thinking-kurs	Bidrag
O4	DT kursmateriell	Bidrag
O5	Flerspråklig kursmateriell og DT-materiale for kurs og workshops	Bidrag
O6	Maler til dokumenter for internasjonalt samarbeid	Bidrag
O7	God praksis i undervisning og læring ved hjelp av Design Thinking-metodikk. («Textbook»)	Bidrag
O8	Undervisningsmateriell for eksterne undervisere. («Toolbox»)	Bidrag

5 Gjennomgang av vårt bidrag i prosjektet

I henhold til tabell 2 hadde UIT helt eller delvis ansvar C1, C3 og C4. Disse arbeidene gjennomgår vi i de påfølgende underkapitellene. I henhold til tabell 3 bidro vi også inn i en rekke arbeidspakker. To av disse arbeidene er vedlagt i rapporten.

5.1 C1 Design thinking-kurs for undervisere

C1 Design thinking-kurs for undervisere var rettet mot faglige ansatte og undervisere fra Lodz University of Technology, University of Vigo og University of Technology and Life Sciences in Bydgoszcz. Deltakerne i kurset var identifisert på forhånd av de respektive universitetene, og de hadde fra før ingen eller begrenset erfaring i undervisning av design thinking og veiledning av design thinking-prosjekter. Formålet med kurset var derfor å gi deltakerne en innføring i hvordan å undervise design thinking, basert på våre egne erfaringer med dette. Kunnskapen som de utviklet i dette kurset, skulle deretter videreutvikles gjennom C2 Lokal trening av undervisere i design thinking, C3 Design thinking-kurs for bachelorstudenter og C4 Internasjonalt casearbeid i design thinking (tabell 3). UIT hadde hovedansvar for gjennomføring av C1 Design thinking-kurs for undervisere og vårt arbeid besto av utvikling av kursmateriell, forelesninger, rekruttering av casebedrift, samt diverse logistikk knyttet til besøket.

Det aktuelle kurset ble gjennomført på UIT fra 15. – 19. januar 2016. Kurset besto av en teoretisk del og en praktisk del. I den teoretiske delen fikk deltakerne innføring i design thinking-metoden, i tillegg til at vi delte våre erfaringer med oppbygging av design thinking-kurs, rekruttering av studenter og deltakende casebedrifter, muligheter og utfordringer i veiledning av praktiske design thinking arbeid m.m. I den praktiske delen skulle deltakerne

selv sette seg inn i skoene til sine fremtidige studenter ved å selv utføre en praktisk design thinking-arbeid. I den praktiske delen arbeidet underviserne med en case fra Tromsø Bibliotek og Byarkiv. Underveis i arbeidet med casen måtte deltakerne benytte seg av design thinking-metoden og tilhørende verktøy som vi hadde gjennomgått i den teoretiske delen. Arbeidet ble avsluttet med en presentasjon av casearbeidet, samt oppsummering og refleksjoner over arbeidet. Tabellen (4) oppsummerer programmet for kurset.

Tabell 4 - Program for C1 Kurs i design thinking for undervisere.

When	Activity
<u>Day 1 (Jan 15th)</u>	
08:45	Meet up at the main entrance of the NFH building at UiT
08:45 – 09:00	Morning coffee in DT Lab
09:00 – 09:30	Welcome by Derek Clark, Director School of Business and Economics
09:30 – 12:00	DT course for tutors – Introduction and history of DT teaching at UiT
12:00 – 13:00	Lunch
13:00 – 16:00	DT course for tutors – part one (Empathy)
19:00 - onwards	Welcome dinner at UiT’s “Ardna” (see directions below)
<u>Day 2 (Jan 16th)</u>	
10:00 – 12:00	DT course for tutors – Part two (Define) and part three (Ideate)
12:00 – 13:00	Lunch
13:00 – 17:00	DT course for tutors – Part four (Prototype) and part five (Testing)
<u>Day 3 (Jan 17th)</u>	
10:00 – 12:00	Selection of groups and case.
12:00 – 14:00	Visit to UiT’s Science Center + lunch
14:00 – 17:00	Practical DT case work
<u>Day 4th (Jan 18th)</u>	
10:00 – 12:00	Visit to “Polaria”
12:00 – 13:00	Lunch
13:30	Meet up in DT Lab at UiT
13:30 – 18:00	Practical DT case work
<u>Day 5 (Jan 19th)</u>	
09:00 – 12:00	Presentations of DT case work + reflections
12:00 – 13:00	Lunch
13:00 – 18:00	C1 Summary and staff meetings
20:00 - onwards	Goodbye dinner at Steakers Restaurant in downtown



Figur 3 Undervisere fra Lodz, Bydgoszcz og Vigo diskuterer under design thinking-casearbeid. UIT / Tromsø. Januar 2016. (Eget foto)



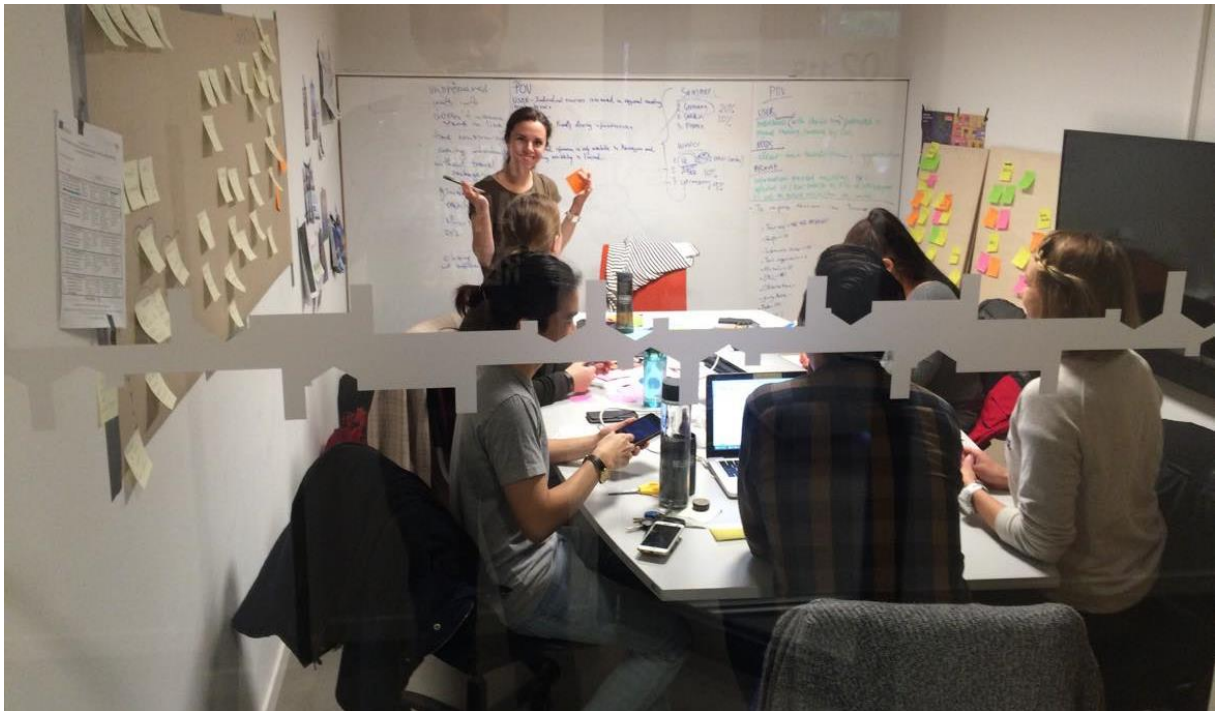
Figur 4 Oppsummeringsmøte under C1 Kurs i design thinking for undervisere. UIT / Tromsø. Januar 2016. (Eget foto)

5.2 C3 Design thinking-kurs for bachelor-studenter

C3 Design thinking-kurs for bachelorstudenter var en aktivitet som skulle gjennomføres lokalt hos hver av prosjektpartnerne ved universitetene i Lodz, Bydgoszcz, Vigo og Tromsø, og vi hadde derfor *lokalt ansvar* for denne aktiviteten. Gjennom dette arbeidet skulle nye bachelorkurs i design thinking utvikles, og en pilotrunde av disse kursene skulle deretter gjennomføres våren/sommeren 2016 ved hvert av universitetene. Kursene skulle undervises etter samme pedagogiske design (teoretisk innføring i design thinking, etterfulgt av et praktisk casearbeid basert på en problemstilling eller case) slik som det var gjennomgått i C1 Design thinking-kurs for undervisere.

Ett av formålene med arbeidet var å starte prosessen med å etablere fremtidige kurs i design thinking hos de respektive universitetene. Ett videre mål var å skape en *arena* hvor deltakerne fra C1 Design thinking-kurs for undervisere fikk muligheten til å selv undervise design thinking-metode for første gang. Også vi (UIT) utviklet en pilot for et bachelorkurs i design thinking gjennom dette arbeidet. Dette til tross for at vi allerede hadde erfaring med undervisning av metodikken. En grunn til dette var at flere av studentene som skulle delta i C3 Design thinking-kurs for bachelor-studenter ved de ulike universitetene, skulle rekrutteres til deltakelse i den påfølgende samlingen C4 Internasjonalt casearbeid i design thinking året etterpå. En annen årsak var at UIT på dette tidspunktet bare tilbydde kurs i design thinking på mastergradsnivå gjennom emnet BED3024 Design of Technological Innovations and Markets, og ikke på bachelornivå slik prosjektet krevde.

Ved å ta utgangspunkt i et etablert emne på HHT (BED2033 Entrepreneurship) som vi selv hadde fag- og undervisningsansvar, samt gjøre tilpasninger i faglig innhold og pedagogisk design i dette emnet, tilfredsstilte vi kravene til DiamonDT for C3 Design thinking-kurs for bachelorstudenter. I emnet ble studentene først introdusert til design thinking-metoden gjennom en teoretisk innføringsdel, før de selv måtte komme opp med en egen oppstartside og bruke design thinking-metodikk til å videreutvikle denne. Oppstartsideene representerte *casen* og det praktiske arbeidet for studentene. I Tromsø ble C3 Design thinking-kurs for bachelorstudenter gjennomført i april-juni 2016, mens de respektive kursene i Lodz, Bydgoszcz og Vigo ble gjennomført i juni-august samme år.



Figur 5 Grupperarbeid i C3 Design thinking-kurs for studenter.. UIT / Tromsø. Juni 2016. (Eget foto)



Figur 6 Presentasjon av gruppearbeid i C3 Design thinking-kurs for studenter. UIT / Tromsø. Juni 2016. (Eget foto)

5.3 C4 Internasjonal casearbeid i design thinking

C4 Internasjonal casearbeid i design thinking ble gjennomført i Vigo, Spania i juni 2017. I denne delen av prosjektet fikk studenter fra Lodz, Bydgoszcz, Vigo og Tromsø mulighet til å jobbe med et praktisk design thinking-arbeid basert på caser fra det lokale næringsliv i Vigo. De tilreisende studentene fra Polen og Norge som deltok i casearbeidet i Vigo måtte søke om plass. Totalt 48 studenter (12 fra hvert universitet) ble invitert til å delta. For å være kvalifisert måtte studentene tidligere ha deltatt i C3 Design thinking-kurs for bachelorstudenter som ble gjennomført ved hvert av universitetene året før. I casearbeidet ble studentene delt i grupper på åtte personer, hvorav to personer skulle komme fra hvert universitet

Ett viktig mål med samlingen i Vigo var å gi de nye underviserne av design thinking fra Lodz, Bydgoszcz og Vigo en videre mulighet til å utvikle sine ferdigheter i veiledning av praktiske casearbeider basert på design thinking-metodikk. For studentene representerte samlingen en mulighet til å oppfriske deres kunnskaper i design thinking gjennom å få mulighet til å arbeide med ett nytt design thinking-arbeid. For studentene fra Norge og Polen representerte C4 en mulighet til å besøke ett nytt land og universitetsmiljø.. Alle deltakende studenter fikk dermed mulighet til å jobbe i grupper med studenter fra andre nasjoner og universiteter og

UIT hadde ansvar for flere aspekter ved gjennomføringen av C4 Internasjonal casearbeid i design thinking. Vi hadde blant annet delt ansvar for teoretisk undervisning av design thinking i starten av samlingen. Undervisningen ble delt mellom de forskjellige universitetene slik at vi kunne veilede hverandre og komme med tilbakemeldinger. Ett videre formål med undervisningen var å tilby studentene en «oppfriskning» av teorien bak design thinking-metode. Videre hadde vi delt ansvar for å veilede studentgruppene underveis i prosjektarbeidet, og som den mest erfarne prosjektpartneren innenfor design thinking hadde vi også et spesielt ansvar for å komme med tilbakemelding på veiledningsarbeidet som ble utført av de nye underviserne av design thinking hos våre samarbeidsuniversiteter.



Figur 7 Åpning av C4 Internasjonalt casearbeid i design thinking. Vigo, Spania. Juni 2017. (Eget foto)



Figur 8 Deltakere fra Norge, Spania og Polen under C4 Internasjonal casearbeid i design thinking. Vigo, Spania. Juni 2016. (Eget foto).

6 Resultater av DiamonDT-prosjektet

Prosjekts overordnede mål omhandlet utvikling av undervisningskompetanse i design thinking-metodikk ved Lodz University of Technology (Polen), University of Vigo (Spania), University of Technology and Life Sciences in Bydgoszcz (Polen) og UIT (Norge).

Målgruppene i prosjektet var faglige ansatte og studenter ved de ulike universitetene.

Prosjektet hadde to sentrale delmål. Disse var:

- 1) *“Prepare tutors in the field of design thinking”*
- 2) *“Provide experience in teaching design thinking”*

Gjennom aktiviteten C1 Design thinking-kurs for undervisere fikk 18 undervisere fra Lodz, Bydgoszcz og Vigo innføring i design thinking-metode og opplæring i hvordan å undervisere metodikken. Deltakerne fikk også muligheten til å selv delta i et design thinking-casearbeid. UIT hadde ansvar for utvikling og gjennomføring av dette kurset, som ble gjennomført i Tromsø i januar 2016. Gjennom aktiviteten C2 Lokal trening av undervisere i design thinking fikk 16 nye undervisere ved Lodz, Bydgoszcz og Vigo videre innføring i undervisning av design thinking-metodikk. C2 ble gjennomført lokalt hos våre prosjektpartnere i juni 2016. UIT var ikke delaktig i dette arbeidet. C1 og C2 førte dermed til at totalt 34 undervisere fikk opplæring design thinking og hvordan å undervise metodikken gjennom prosjektarbeidet. I tillegg til C1 og C2 ble det utarbeidet en rekke støtteressurser for nye undervisere av design thinking gjennom arbeidspakkene O1-08. Disse støtteressursene inkluderte diverse undervisningsmaterieell, emnebeskrivelser, verktøykasser m.m. Materiellet er tilgjengelig gjennom EUs nettside for prosjektet og er av prosjektkoordinatoren ved Lodz University of Technology oversatt på fire språk (norsk, engelsk, polsk og spansk). Disse resultatene svarer direkte til prosjektets delmål 1 om å forberede undervisere i design thinking-metode.

Gjennom aktiviteten C3 Design thinking-kurs for bachelorstudenter ble det opprettet og gjennomført fire pilotkurs for design thinking ved Lodz University of Technology, University of Vigo, University of Technology and Life Sciences in Bydgoszcz og UIT. Kursene ble gjennomført ved de respektive universitetene våren/sommeren 2016. Deltakerne fra C1 og C2 hadde selv ansvar for undervisning av disse kursene, og fikk på den måten praktisk erfaring med undervisning av design thinking. Videre, gjennom aktiviteten C4 Internasjonal casearbeid i design thinking fikk de samme underviserne videre mulighet til å undervisere og

veilede studenter. C4 ble gjennomført i Vigo i juni 2017. Disse resultatene svarer direkte til prosjektets delmål 2 om å gi potensielt nye undervisere av design thinking-kurs erfaring med undervisning av metoden.

I tillegg til prosjektets resultater tilknyttet delmål 1 og 2 har DiamonDT-prosjektet ført til at over 120 studenter fra Norge, Spania og Polen har fått innføring i design thinking-metodikk gjennom kursene gjennomført i aktiviteten C3 Design thinking-kurs for bachelorstudenter. 48 av disse studentene har videre fått muligheten til å opparbeide seg videre kunnskap og ferdigheten i design thinking-metodikk gjennom deltakelse i aktiviteten C4 Internasjonal case-arbeid i design thinking. I tillegg til den faglige kunnskapen og ferdighetene har disse studentene også fått mulighet til å jobbe sammen i internasjonale grupper og fått innblikk i nye kulturer. Figuren (9) under oppsummerer flere av prosjektets resultater.



Figur 9 Illustrasjon over utvalgte prosjekresultater fra DiamonDT (Lodz University of Technology, 2017) <http://diamondt.p.lodz.pl/#results>.

Prosjektet har videre bidratt til at nye kurs, programmer og andre design thinking-aktiviteter har blitt opprettet av prosjektpartnerne. Både Lodz University of Technology og University of Vigo har utviklet kurstilbud i design thinking i etterkant av prosjektet (Lodz University of Technology, 2022; University of Vigo, 2022), mens University of Technology and Life Sciences i Bydgoszcz holder en årlig konferanse i design thinking (Polishopa, 2022), som til nå har hatt 135 foredragsholdere og 1800 deltakere fra flere europeiske land, inkludert UIT. For UIT har gjennomføringen av aktiviteten C3 Bachelorkurs i design thinking vært med på å danne grunnlag for prosjektet Idegeneratoren ved UIT (Brattli og Utne, 2022) og tilhørende utvikling av bacheloremnet BED2054 Innovasjon i Praksis (UIT, 2022) som baserer seg på design thinking-metode.

7 Konklusjon

Prosjektet «Development of Innovative Academy on the basis of DT Teaching» (DiamonDT) ble utført av Lodz University of Technology (Polen), University of Vigo (Spania), University of Technology and Life Sciences in Bydgoszcz (Polen) og UIT. Prosjektet var finansiert av Europakommisjonen gjennom Erasmus+ KA2 - Cooperation for Innovation and the Exchange of Good Practices Strategic Partnerships for higher education»-program. Prosjektets overordnede mål var å utvikle kompetanse i undervisning av design thinking hos de samarbeidende universitetene. Prosjektets delmål 1 omhandlet forberedelse av nye undervisere av design thinking. Prosjektets delmål 2 omhandlet å gi disse underviserne praktisk erfaring i undervisning av design thinking.

UIT ble invitert til å delta i prosjektet ettersom vi allerede hadde erfaring i undervisning av design thinking gjennom prosjektet DT Lab på HHT. Vårt bidrag i arbeidet inkluderte utvikling av et kurs i hvordan å undervise design thinking gjennomført i Tromsø i januar 2016, utvikling av et pilotkurs i design thinking for bachelorstudenter gjennomført i Tromsø våren 2016, veiledning under et internasjonalt casearbeid i design thinking gjennomført i Vigo i juni 2017, samt bidrag i utviklingen av støtteressurser for undervisning av design thinking.

Aktivitetene i DiamonDT ble gjennomført fra 2015 til 2017. Prosjektet førte til at 34 mulige undervisere i design thinking fra Lodz, Bydgoszcz og Vigo fikk innføring i hvordan å undervise design thinking. Underviserne fikk også praktisk undervisningserfaring ved å ha undervist og veiledet studenter gjennom både lokale og internasjonale design thinking-kurs i prosjektet. Undervisningsmateriell og andre støtteressurser har blitt utviklet og åpent publisert for fremtidige undervisere av design thinking. Disse resultatene svarer direkte til prosjektets delmål 1 og 2. Prosjektet førte videre til at over 120 studenter har fått opplæring i design thinking-metodikk. Flere av prosjektpartnere, inkludert UIT, har utviklet nye kurs og andre tilbud innenfor design thinking-metodikk i etterkant av prosjektet.

Vi konkluderer med at arbeidet utført gjennom DiamonDT har svart til prosjektets hovedmål om å utvikle kompetanse i undervisning av design thinking ved Lodz University of Technology, University of Vigo, University of Technology and Life Sciences in Bydgoszcz, og UIT Norges arktiske universitet.

8 Referanser

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9 Vedleggsoversikt

Vedlegg 1 – Finansiering UIT

Vedlegg 2 – Textbook

Vedlegg 3 – Toolbox

Vedlegg 1 – Finansiering UIT

ERASMUS+
KEY ACTION 2 – Strategic Partnerships
ANNEX NO 1 Partnership Agreement between Coordinator and Partner

All correspondence related to the present agreement should be directed to:

Lodz University of Technology

Identification of the Financial Agreement

Name of the Project: Development of Innovative AcadeMy ON the basis of DT teaching

A.1 Reference Number of Financial Contract: **2015-1-PL01-KA203-016844**

A.2 Name and address of Coordinator and Partner

Coordinator	Partner
Name of the organisation: <i>Lodz University of Technology</i>	Universitetet i Tromsø
Country: <i>Poland</i>	Country: <i>Norway</i>
Legal representative (signatory) <i>Vice-Rector for Education</i> PROFESSOR GRZEGORZ BAK	Legal representative (signatory) Faculty Director Terje Aspen

A.3 Maximum grant attributed to the Partner under this agreement: **€ 54 542,00 Euro**

A.4 Purpose: The ERASMUS+ National Agency in Poland (Foundation for the Development of the System of Education) has decided to award a grant, under the terms and conditions set out in the Grant Agreement for Strategic Partnerships number **2015-1-PL01-KA203-016844** for the Project Development of Innovative AcadeMy ON the basis of DT teaching. With the signature of this Partnership Agreement, the Coordinator will attribute part of the Project grant to the Partner under the terms and conditions of the Grant Agreement, which forms an integral part of this Partnership Agreement and which regime regulates the relationship between both parties in all matters other than that which are regulated in particular in the present Partnership Agreement.

A.5 Eligibility Period: The Project shall be implemented between **01.11.2015** and **31.10.2017**, both inclusive.

A.6 Pre-financing Arrangements: The Coordinator will provide the Partner from the pre-financing received from the Polish ERASMUS+ National Agency, a first pre-financing of 40% of the maximum grant amount allocated to the Partner as specified in A.3. The second pre-financing payment, corresponding to 40% of the grant amount will be paid to the Partner within 30 days after the Coordinator has received the interim report as specified in A.7. The payment of the balance, for the remaining part of the eligible costs incurred by the Partner, will be paid to the Partner within 30 days after the Coordinator has received the final balance of the Project in accordance with the payment arrangements for the Project provided in Article 1.4 of the Grant Agreement (i.e. 6. days after the final report has been submitted to the National Agency).

The Coordinator shall perform transfers to the following account:
Account holder: UIT Norges arktiske universitet
Account holder address: Postboks 6050, Langnes 9037 Tromsø
Bank name: Sparebank 1 Nord-Norge

Bank address: Postboks 6800, 9298 Tromsø, Norway
 IBAN code:NO 59 4714 1001 236
 BIC/SWIFT code: SNOWNO22

- A7. Interim and Final Reports: By 15th October 2016 the Partner shall complete interim reports on the implementation of the project Development of Innovative AcadeMy ON the basis of DT teaching in a format provided by the Coordinator at least 30 days before the deadline for the submission of the interim reports to the National Agency. Within 30 days after the end date of the Project as specified in point A.5 the Partner shall complete a final report on the implementation of the Project in the format provided by the Coordinator to the Partner at least 30 days before the deadline for the submission of the final report. The final report is considered to be the Partners' request for payment of the balance of the maximum grant given in points A.3.
- A8. Changes and amendments to the Partnership Agreement shall be approved by both parties and will become effective when signed by the authorised representatives of both parties.

Name of Partner Organisation	PIC	Project Management and Implementation	Transnational Project Meetings (TPM)	Intellectual Outputs	Travel: activities related to teaching/ learning	Individual support, activities related to teaching/ learning	TOTAL
Universitetet i Tromsø	999874643	6000,00 €	7045,00 €	30 457,00 €	4320,00 €	6720,00 €	54 542,00 €

Signatures of Legal Representatives

For the Coordinator:

Name: PROF. GRZEGORZ BAK

Signature:

Prorektor ds. Studenckich
 Politechniki Łódzkiej
 dr hab. inż. Witold Pawłowski, prof. PŁ


Place, / /

For the Partner:

Name: TERJE ASPEN

Signature:

Terje Aspen
 Tromsø
 Place, 0409 2017



Vedlegg 2 – Textbook

Diamon DT

TEXTBOOK

Preface

The “DiamonDT” - Development of Innovative AcadeMy ON the basis of DT teaching, is a project which focuses on design thinking in higher education and is realized by consortium consisting of four Partners: Lodz University of Technology (Poland, Coordinator), University of Vigo (Spain), University of Tromsø (Norway) and University of Science and Technology in Bydgoszcz (Poland).

The DiamonDT Project was written with the needs to develop knowledge, discover new possibilities and share experiences with regard to design thinking methodology on national and international level.

This book shares the effects of experiences exchange and disseminates knowledge towards design thinking usage in education and project realization.

This book was written by people who in different countries all over the Europe apply design thinking process in education and business. By educators, mentors and tutors who experience design thinking in various environments.

In each team of the DiamonDT Project Partners there are members who experienced design thinking at Institute of Design at Stanford University (USA) - d.school, where design thinking methodology was created, but also in European environment – at their home universities. In this book they share their knowledge which is based on experience in various dimensions of application – educational, practical, among students and business in smaller or bigger groups, various nationalities, etc. By exchanging remarks, knowledge and experiences they were able to describe what is the most effective way to conduct the process depending on nationality aspects of teams’ members or kind of end-user the problem is solved for.

Thanks to the above in your hands you have a valuable book for educators, for design thinking beginners and all others who would like to discover and learn how to understand, use and apply this methodology. This book will help you to introduce practically the design thinking process into the education path and problem solving process. It will be helpful to understand the meaning of each step, threats and opportunities encountered during the various stages of process realization.

In this book you will read that “... the goal of design is not to discover an existing truth through traditional analytical thinking. That's the role of science. Instead, design thinkers seek to invent the future through synthesis”. Next pages of this book give you instruction, how conduct the process in the most effective way, what are the threats and dead ends as well as tips and links where collect more cases and information.

I hope this book will be a valuable lecture regardless of your experience level and you will often open its pages not only to read, but also in order to add notes based on your own experience.

Dorota Bociąga

DiamonDT Project Coordinator

Contributors

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<p>Alexander Utne UiT The Arctic University of Norway School of Business and Economics</p>	<p>Mateusz Wirwicki University of Science and Technology in Bydgoszcz</p>

INTRODUCTION ABOUT THE DIAMOND T PROJECT

Krzysztof Jastrzębski

Nowadays Europe needs higher education not only to pass relevant knowledge and help students to prepare for professional life and work, but also to equip them with a set of transversal skills and team work experience. In order to meet these requirements, the European consortium of **DiamonDT** project was established to offer ways to upgrade the educational systems by improving the way of teaching. Especially, it aims at enhancing the creativity and focusing students attention on development of innovative solutions tailored to the real needs of local communities as well as global society.

DiamonDT (Development of Innovative AcadeMy ON the basis of DT teaching) project that started in October 2015 is co-funded by the Erasmus+ Programme of the European Union. The project is coordinated by the Lodz University of Technology (TUL) and conducted together with its partners in the field of higher education from: Spain (UV – University of Vigo), Norway (UiT – University of Tromsø) and Poland (UTP – University of Science and Technology in Bydgoszcz). The main scope of the **DiamonDT** project is the creation of European standard for novel education path which consists of the design thinking and problem based learning where learning is realized “by doing”. The project aims at sharing knowledge and experience coming from all partners in the area of education as well as from cooperation with business. **DiamonDT** project offers a development of an educational path based on Design Thinking methodology addressed to three target groups: students, academic teachers and implicitly business environment as well. An educational path based on Design Thinking enables realization of learning “by doing” when students solve problems directly related to business or real problems of SMEs and big companies. In that way, project leads to the improvement of the human resources potential, influence the labour market and the development of the innovativeness at the local, European and the global level.

The **DiamonDT** project was held to provide an innovative tool into the methods of teaching and learning. The major activities of the project are: professional training of the selected academic staff (Masterclass for DT Tutors), introduction of a pilot course in Design Thinking into the first-cycle study programmes of participating institutions and organization of summer events for students: National Good Practice Academy and International Good DT Practice Exchange in the period of 24 months from the start of the project realisation. What is more, realization of the project involves the development of teaching materials for study courses, materials used for tutors' training about DT methodology, multilingual course materials and DT handout.

This free of charge publication was prepared for the sake of academic lecturers that start teaching Design Thinking or would like to introduce its elements to the courses that they already conduct. Within the scope of that issuance is the detailed description of key stages of DT process, examples of its implementation as well as tips helpful in preparation of classes or project involving DT. The Design Thinking TEXTBOOK is directly linked to Design Thinking TOOLBOX that is a collection of exercises helpful in work with DT methodology.



Kick-off meeting in Lodz – November 2015



MasterClass for DT Tutors in Tromso – January 2016

INTRO TO DESIGN THINKING

Federico Lozano

Design Thinking

Design thinking is a practical, human-centered, prototype-driven methodology for innovation that tackles business challenges in creative ways. These challenges can encompass the development of new products, services, and experiences; the design of new business models; or the structuring of new organizational processes. Design thinking is multidisciplinary in nature: it helps to merge the worlds of design, technology, and business under one powerful, problem-solving tool set. The design-thinking process begins with gaining empathy for the user and ends with the real-world implementation of products, services, processes, experiences and/or systems.

Shoes of Others

So-called *design thinkers* begin by focusing on the human experience. It is understood that the most impactful innovations are those that address important human needs in meaningful ways. To understand these needs, design thinkers adopt a deeply empathic perspective by standing in the shoes of others, and experiencing life from their perspective. This is not new, of course. Anthropologists and ethnographers have been doing this for generations. Design thinking simply relays this powerful approach to address the challenges of modern-day companies.

Re-Iterating

Design thinkers embrace iterations by building rough and rapid prototypes, and testing them early on. At first this can feel chaotic and risky. Design thinkers quickly become comfortable with trial and error, however, and value the immediate feedback that it provides. They are open to small, early failures, which can eventually pave their way to success. They don't, however, think that failure is fun. That would be disingenuous. All they do is train themselves — and the companies they are working for — to embrace failure for the learning opportunity that it really is.

Block Busting

Design thinkers understand that with the right approach, people minds can become boundless. Quite often, however, the flow of creative ideas becomes obstructed by social constructs, self-imposed cognitive limitations, and personal biases, which mankind inevitably adopts as it grows older. Design thinkers learn to break these mental blocks by deferring judgment, letting go of unhelpful preconceptions, building on the ideas of others, and bringing mindfulness to everything that one does.

Q's over A's

Design thinkers focus more on asking the right questions than coming up with the right answers. This is because the goal of design is not to discover an existing truth through traditional analytical thinking. That's the role of science. Instead, design thinkers seek to invent the future through synthesis. And because there is no single 'right future,' but instead many 'possible futures,' asking the right questions helps them explore multiple possibilities – eventually honing in on the most appropriate one.

Co-Concoction

Although some quiet, independent thinking can be good for idea generation, design thinkers recognize early on that meaningful, human-centered innovations can only flourish through team-based, social processes. Design thinkers constantly seek opportunities for radical collaboration and co-creation. It is through the cross-pollination of multiple perspectives, ideas, and approaches that the creative process flourishes. They leverage diversity in all its forms – gender, cultural, academic, professional – to break with the status quo.

Serious Playing

Designing new products, services, and experiences is inherently ambiguous and messy. Design thinkers embrace this non-linearity and chaos through open-mindedness, flexibility, and a youthful sense of experimentation and play. They acknowledge that micromanaging or overcontrolling the innovation process is not only futile, but also counterproductive. Design thinkers revel in uncertainty, improvise constantly, trust their gut feeling, and laugh a lot. They don't take themselves too seriously, but they take what they do very seriously.

DESIGN THINKING ROOTS

Manuel J. Fernandez Iglesias

Design Thinking is a methodological approach to problem solving in a creative way. The actual term 'design thinking' was originally used by Peter Rowe at the Harvard Graduate School of Design in 1987. However, design thinking as we know it today was developed around fifteen years later, during the late 2000's.

Design Thinking encompasses a collection of methods and processes best tuned to investigate problems that are not sharply defined, situations where the actual user requirements are not crystal clear for many different reasons, like problems addressed for the first time, changing technological requirements, or evolving social or economic environments. Thus, Design Thinking focuses on obtaining information as richer as possible from all stakeholders involved; analysing the obtained information from many different perspectives, and proposing novel solutions and original deployment plans.

Design Thinking can be seen as a design- and user-oriented way of thinking. It combines knowledge acquisition with a deep understanding of the context where problems originate, with creativity to present novel solution proposals, and with rationality to confront such solutions with the limitations imposed by reality.

This methodological approach was originally applied to design, and from there it was adopted in the fields of engineering and management. However, Design Thinking is starting to play more and more relevant role in the field of education at all levels, as it may dramatically improve the students' problem-solving abilities, foster collaboration, and expand student perspectives. Having its origins in design, it also influences the design of student spaces and school systems to adapt to the requirements of an ever evolving society where innovation and user-centeredness play a fundamental role.

In addition to the benefits above, design thinking can also benefit education professionals, as it offers innovative ways to design their lesson plans and help to integrate technological advances in the classroom in a more user-friendly way.

As stated in (Carroll et al, 2010)¹, "Much of today's education system guides students toward finding the correct answers to fill-in-the blanks on standardized tests, as this kind of instruction facilitates streamlined assessments to measure success or failure... It is critical that, particularly in under-served schools this model of learning does not continue to prevail. Students need both the skills and the tools to participate in a society where problems are increasingly complex and nuanced understandings are vital."

¹ Carroll, M., Goldman, S., Britos, L., Koh, J., Royalty, A. and Hornstein, M. (2010), Destination, Imagination and the Fires Within: Design Thinking in a Middle School Classroom. International Journal of Art & Design Education, 29: 37-53.

DESIGN THINKING CASE STUDIES

Robert Banasiak

The Embrace story on the basis of Stanford University Design Thinking Project

The Challenge

Each year, around 15 million premature and low-birth-weight babies are born in the world. In developing countries, mortality for these infants is particularly high because incubators in hospitals are supposed to be extremely rare. It was believed that most hospitals and clinics in developing countries don't have enough incubators to meet the tremendous need. New incubators are extremely expensive. Moreover, the donated incubators are confusing to operate, being difficult to maintain and repair as well.



The Insight

Some time ago, a group of students at the Stanford Design School (<http://dschool.stanford.edu/>) started a course called Design for Extreme Affordability creating affordable and appropriate technologies for people living on less than a dollar a day. The challenge posed to them was to identify reasons of high mortality of infants in developing countries. They first came to understand the scale for the problem, which is staying premature and low birth weight babies warm or regulating their body temperature. The team began their need finding in Kathmandu, the capital city of Nepal. After spending several days observing the neonatal unit of the Kathmandu hospital, the team asked to be taken outside the city to see how premature infants were cared in rural areas. They were aware that observation of the end-user in his natural environment is necessary. They learned two alarming things. First, the overwhelming majority of all premature Nepalese infants were born in these rural areas. And second, most of these infants would be delivered to a hospital because their mothers are not able to do it. Students realized that no matter how good their design for a new incubator would be, it would never help these babies in their living places if it stayed installed in a hospital. To save the maximum number of lives, their design would have to function in a rural environment far from the hospital and would have to be easy to use by mothers. It would also have to work without electricity and be transportable, intuitive, sanitizable, culturally appropriate, and perhaps most importantly – relatively inexpensive.

The Testing

The team took the prototype to India, where they sought to understand the cultural nuances that could lead mothers to accept or reject the device. Along the way, they discovered factors they could never have found if they had stayed at home in Silicon Valley. For example, one day one of the team members Rahul Panicker (future Embrace CTO) was in a small town in Maharashtra state showing the prototype to a group of moms. He told the moms to warm the heating pouch to thirty-seven degrees Celsius to help regulate the baby's temperature, he got a surprising and unsettling response. One of the village mothers explained that in her community they believed that Western medicines are really powerful but often too strong. So if the doctor prescribed one teaspoon of medicine for her baby, she told Rahul, "I give him just half of a teaspoon. Just to be safe. So if you ask me to heat it to thirty-seven, just to be safe I would heat it only to thirty or so." Alarm bells went off in Rahul's head. Now, when the baby warmer reaches the correct temperature, an indicator simply changes to "OK," so there was no numeric value for parents to second-guess. In this instance, prototyping with end users in the field led to an improvement that may make sometimes the difference between life and death.

The introducing on the market

Since the design class ended, the team has pushed forward. They strengthened their team with several new members, incorporated as a non-profit company, and began to improve their business plan and seek funding. Finally they started the Embrace start-up. The Embrace began to win awards and small amounts of seed funding from business plan competitions and attract media attention. Encouraged by these small victories, Embrace



refined their design and was prepared for clinical trials in India (2011-2013). Jane Chen (Embrace CEO) and Rahul Panicker (Embrace CTO) won Echoing Green Fellowship in 2008, a prestigious award given to the top 20 social ventures out of almost 1,500 applicants. They also won the BASES Social Entrepreneurship Challenge at Stanford in 2013. Together, these two wins will provide them with \$125,000 to pursue Embrace further. Customers come from private clinics, government clinics, and NGOs. Embrace warmers have been used to care for over 200,000 low birth weight and premature infants across 20 countries: Afghanistan, China, Ethiopia, Ghana, Guatemala, Haiti, India, Kenya, Malawi, Mali, Mexico, Mozambique, Nigeria, Rwanda, Senegal, Somalia, South Sudan, Tanzania, Uganda, and Zambia. In 2016, manufacturing of the infant warmer was transferred to Phoenix Medical Systems in India.

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DESIGN THINKING STEP BY STEP

Cezary Graul, Magdalena Kowalska, Filip Sieracki, Mateusz Wirwicki

In the **Textbook** the 6-step design thinking model is used (Fig. 1). First step – **empathize** is divided into two sub-steps – **understand** (1) and **observe** (2). **Test** (6) is not the last step in creating a new solution. Next steps - **commercialization** and **implementation**, albeit crucial, are not directly involve in DT methodology. Therefore, they are just shortly described below, but intentionally skipped in other parts of **Textbook**.

DESIGN THINKING MODEL

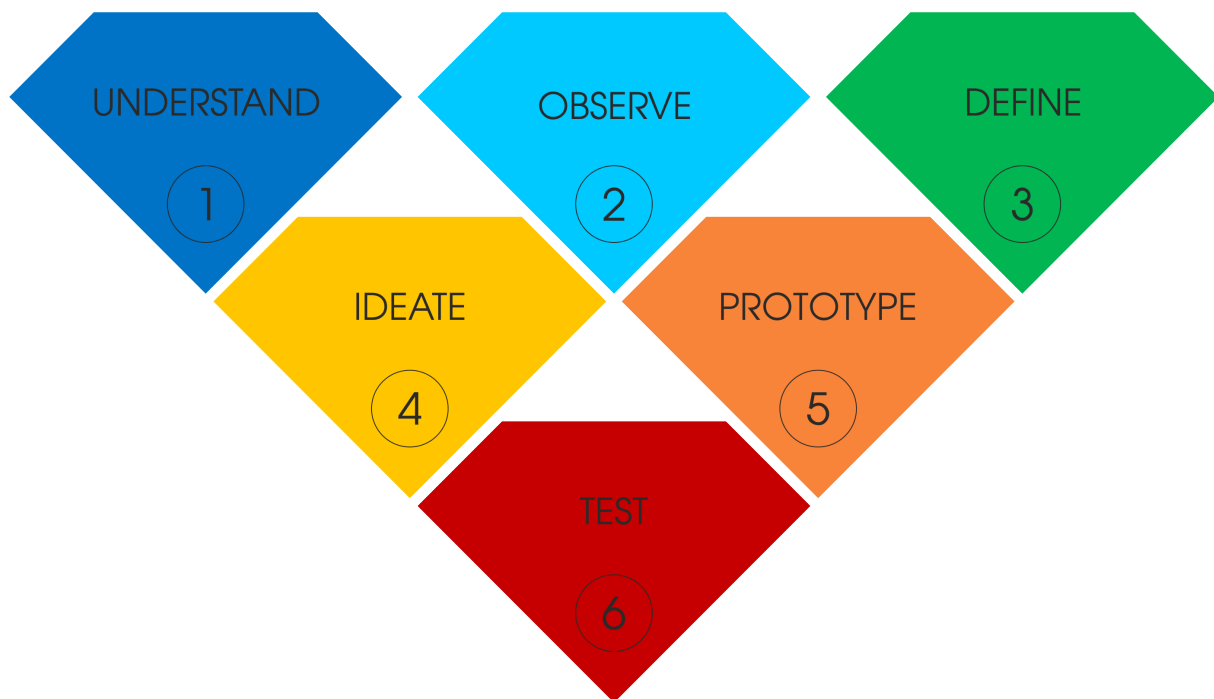


Fig. 1. Model of design thinking process (own graphics - DiamonDT)

Understand

Understanding and acquiring knowledge about the issue is first step of the process. In this part of the process, team members talk with experts and carry research (usually using available literature and market survey). Main goal of understand is to gain a lot of information about the issue/ topic, then team can focus on the challenge.

Observe

At this step teams observe people's behaviour, their interactions and environment. Design thinkers talks with users, ask questions about their habits (why and when) connected with problem or issue. Collecting this information together with knowledge from the first step helps to empathize with user and feel in the "user's shoes".

Understand and **observe** can be categorised as just one step – **empathy**, as is often done among design thinkers.

Define

This step is important and critical. Team members try to find and define needs of final customer. Main goal is to do **Point of View (POV)**, which constitutes the starting point for ideation. This step should be ended with information of changes that make impact to the issue.

Ideate

In an ideation step team generates a lot of ideas and concepts of solving the recognised problem using such tools as e.g. brainstorming. Amount of ideas plays a crucial role, the more the better and it will help in further steps of the DT process. The ideas should be various and crazy, having always in mind to not judge them. Process should be inspiring enough to generate a lot of solutions, from which the best idea or combination of various proposals can be selected. At the end of this step team has to go from “sky is the limit” to the ground and chose 1-2 solutions.

Prototyping

Prototyping is a dynamic and very fast stage in the first cycle of design thinking. A prototype can be a sketch, model or painted cardboard box. The prototyping goal is to visualize quickly the idea creating a tangible 3D model that can be touched, which will help in further communication, eliminate basic errors and further inspiration. The lesson that the team draws from this stage: it is a much higher profitability of failure in the early phase than the high risk of rejection final product (finished and usually expensive) by the customer.

Testing

At this stage team members present the prototype to the final customers and collect their opinions. They should not suggest anything. Customer observations and comments play the most important role here. Testing is for finding out whether the prototype meets the expectations and its weak points that need to be improved. After receiving the response from the end user, the team returns to the stage of prototyping in order to improve or even to the previous DT steps and repeats the process if it is necessary. Testing allows us to understand and learn what is the viewpoint of final user.

Commercialization & Implementation

After the whole DT process an interdisciplinary team presents their results in front of the final investor. They show the prototype of the product which in several iterations meets the requirements of the final customer. The next stage is its commercialization and deployment – transfer of research results or technology to business.



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Laurent>About

STEP 1: Empathy

The first thing to do when starting a project conducting via the DT methodology. Indeed, the first step of the DT process relies in seeking and understanding the needs of specific users. Here we assume that a challenge or problem has been defined by a third-party (e.g. DT teacher, team mentor, a company or external contractors) and team (of students e.g.) will have to find target users to whom the challenge may apply. As it has been explained earlier, design thinkers usually will go through this process having an attitude that foster establishment of close contact. Some DT experts separate this empathy step into two parts²: they first consider an *understand* step, aiming at immersing in the project by talking with experts and carrying out research (usually literature survey). Then, an *observe* step encourages observation/immersion into human behaviours in particular context and verbal communication (interviewing) to search for explanations. Our experience shows that students rarely enjoy this *understand* step (at least the research aspect) and don't dedicate enough time to reading (they usually go to the simplest reachable internet multimedia documentation rather than looking for press releases or scientific articles). Secondly, because of the standard top-down teaching method and associated passive attitude of students, the proactive activities that *observe* step requires is not always innate for students. While final BSc or MSc projects will encourage self-learning via classical research approach, it is the right time during the beginning of the studies to "inoculate" students with empathic-based know-how.

Empathy vs. sympathy

This ambiguity can be resumed as follows: it is "I know what you feel" instead of "I am sorry for what you feel". Who does that the best? Doctors, psychologist, lawyers are thought to master such ability. However, reaching the empathy state may be seen not enough. Also, compassion is an ingredient that students should reveal. While the ability to empathize will help teams understanding people's need, compassion will act as a driving force that motivates them to act for a good reason, that is designing a thing that may alleviate the pain/foster a better life of/to others.

How to get empathy?

In a general manner, there are several ways to "empathize" with people – interviewing and immersing in user's environment are the most famous ones, as summarized in Table 1. Other methods, like group session or questionnaire are rather proscribed by DT experts. Indeed, group session tend to create group conformity, as revealed by the Asch conformity experiment³. An example: if it is asked to a class of primary school kids to draw, let say, an ideal activity to share with relatives, it is highly probable that most of them will draw very similar situations. In such case, nothing will be learnt. Rather, the activity should be performed with individuals. Using questionnaires is also not advised since, apart for the long preparation process, students will not have control on the respondees' dedication and implication to fill in the forms. Still, questionnaires are very popular for students, mainly for one reason: easy access and reply via internet. In that case, we are far, far away from *Empathy Land*.

² https://dschool.stanford.edu/groups/k12/wiki/17cff/Steps_in_a_Design_Thinking_Process.html

³ Asch, S.E. (1951). Effects of group pressure on the modification and distortion of judgments. In H. Guetzkow (Ed.), *Groups, leadership and men* (pp. 177–190). Pittsburgh, PA: Carnegie Press.

Interview

This part could also be called "the art of questioning" as interview is not about asking question, it is about asking good and revealing question. One main rule that all DT teachers will pass to their students is the obligation not to use "YES/NO" question during interviews. Indeed, these drive naturally the interviewee for short answer. A way to remedy to such a question is to ask after a "why" question, in order to look for meanings. The interviewer needs to feel a bit like a psychoanalyst and search for answers that will reveal personal stories (without going too much into intimacy: this could curb their willingness to open their mind), experiences, emotions, beliefs and opinions. A possible strategy to convey an interview session is illustrated in figure 2.

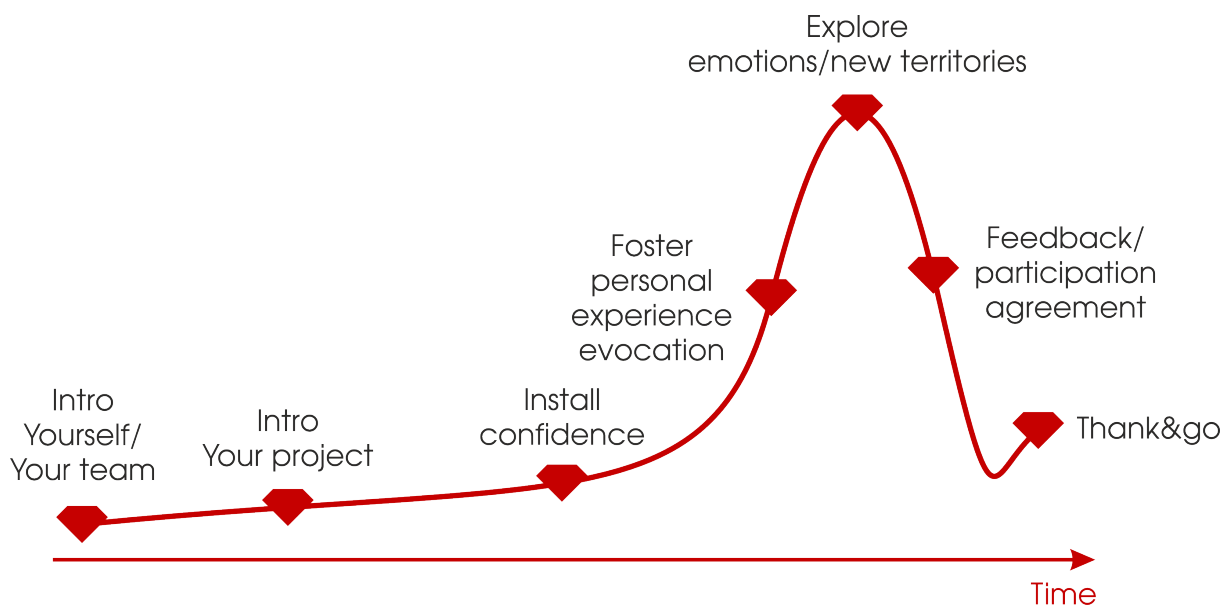


Fig. 2. The steps of well-conducted interview during the empathy

After introducing the team and the project, the following categories of questions can be articulated:

- warm-up/personal questions: *have you already been interviewed in the past? When have you started to work as...?*
- focus-based questions #1. Students could think of specific questions the interviewee will be comfortable answering in order to install confidence, e.g. *"Please tell us about any situation you have encountered with...?", "What is your personal opinion about...?"*
- focus-based question #2, or rising emotional exchange level by asking questions that target feelings and force interviewee to think deeper about new perspectives.
 - *What is a typical challenge you have to face when...?*
 - *How did you feel when...?*

- *What would you like to change in ... if you had ...?*

Students should also observe the interest of the interviewee about the challenge and even foresee his/her further implication in the project, especially for the **Test** step. It is worth to take a contact information to these people in order to be able to find them and ask about their reaction to the presented solution (prototype).

A general characteristic that concerns all these questions is that they should be formulated in a neutral way. Here, we don't suggest answers to questions, as this will kill the process of discovery. For example, instead of asking "*Don't you think that bike renting would be great in your city?*", rather "*What do you think about bike renting?*" should be asked.

Immersion

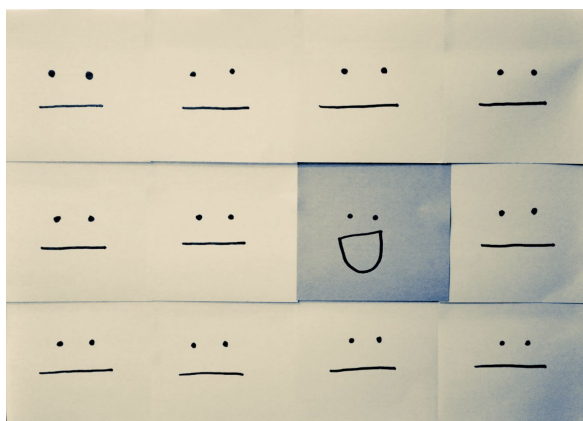
Bronisław Malinowski, a famous anthropologist of the XXth century once said: "to understand people, you cannot rely on what they say they do. You have to rely upon yourself, watching and seeing what they do". This is the main philosophy behind the notion of immersion or participatory observation that is so important for design thinkers. When possible, DT tutors should motivate their team to plan fieldtrip in order to observe users in their environment. You have to design new equipment for fire fighters? Become a fire fighter and immerse in critical situations that allow you to feel the peculiar environment they have to face in some extreme cases. Design something for the homeless or taxi driver? Become a homeless or a taxi driver for one day! Of course, this demands a lot of effort, but the game is worth the candle, as it will reveal real insights on human behaviour in particular context.

If some obstacles (like intimacy issue) hinder immersion, one can ask users to do self-documentation, that is to say issue a kind of personal document that reflects actions and emotions that happen during a certain period of time. The process involves the design thinkers upstream, because they define what to be observed by the sole user. However, the liberty that is given to the users may be also a drawback, since his/her own observation can be seen as emotionally subjective. Ultimately, a verbal feedback is strongly advised to question again the findings.

Table 1. Popular ways to interact with user(s).

	Group session	Interview	Immersion	Self-documentation	Questionnaire
Aim	Express/discuss perceptions, opinions, beliefs, and attitudes towards a focus problem	Interviewer asks questions to elicit facts or recollection of experiences, emotions, beliefs and opinions from the interviewee	Feel in the shoes of users, to understand their logic and emotions	Participants record their own experiences, guided by your instructions. Capture thoughts, decisions and emotions	Research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents
Structure/ place	Round table discussion	Face-to-face	User's environment	User's environment	Anywhere but intuitively depends on focus / targeted users
Pros	Good overview of a topic More data (for cheaper) in less time	Can happen anywhere More intimate than group session Data can be shared easily	As close to emotional empathy as you can get You experience is your data	Access problem Intimate environment. Learning over extended period of time	Large data set Information on specific focus
Cons	Difficult to facilitate, keep focus Less rich, descriptive data Group conformity	Mainly rely on what interviewer asks and what interviewee says	Very time consuming Your experience is your only data Very reflective	No direct control with data May be subjective data	Needs a lot of preparation Can cost money (printing issues) No control on respondent's dedication

Attitude



Students should embrace the *Whatever-it-takes* attitude. Empathy is a very long process. While ideation and prototyping steps may look like sprints that we often repeat, the empathy process may look like a marathon! Students may feel discouraged by interviews that do not reflect what could be expected (even though they should always have in mind to *expect the un-expectable!*), difficulty to find inspiring good places to observe or where to immerse in (especially if they want to immerse in people

premises). This phase needs a lot of planning and perseverance since this is the only one (except testing) where the teams don't control all the settings. However, experienced designers will say that this is one of the most exciting part of the process, as the contact with real persons and the

inherent goal of doing something relevant to people needs make this empathy experience quite unique.

TIPS

- ◆ For interviews, mainly three team members are needed: one who conducts interview, one who takes notes and one who observes the interviewee/take pictures. More than three team members is not recommended, then the interviewee may feel overwhelmed.
- ◆ Come to interview with pre-defined questions, but don't focus of their order. The interview may turn differently that what you could imagine.
- ◆ Make a transcript of the interview as soon as possible. Don't wait too long between this step and the next one, i.e. Define. Make a copy for all team members, because transcripts are usually served the base material for the Define step.

TIPS



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STEP 2: Definition

How correctly was the problem diagnosed depends on how good we were able to observe and understand interviewees on the basis on conducted empathy step. How desirable will be the solution by end users depends on how accurately the problem was defined. Definition of the problem (the second step of the design thinking process) is like a “dead-center” point of the process and thus the most important step of it influencing the rest of the work.

On the basis of information obtained during interviews the empathy map (Fig. 3) and the affinity map (Fig. 4) can be built.

Very often the “real” problem that is something different than the one we think at the beginning or what the customer/company brings as the main issue to solve. Let's take the following example to illustrate this.

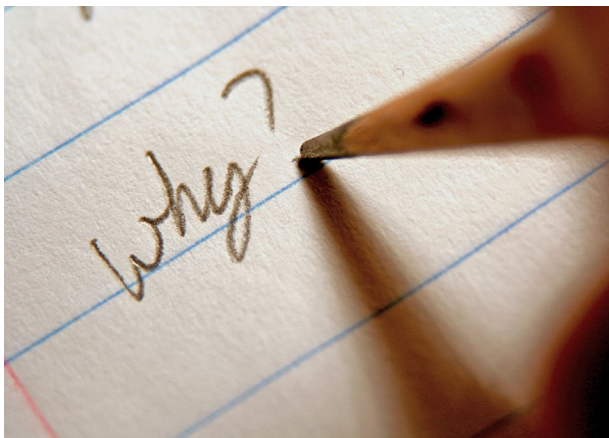
A shampoo producer considers the necessity to put on the market a new shampoo formula because their clients stopped buying their product. The company says: “we have a problem with our shampoo formula”. If we stop at this point we define the problem as: the shampoo formula is probably outdated in comparison to the competition so it should be improved. Then, as the next step the company needs to buy some new patents, introduce some new solutions, ingredients, etc. That costs a lot of money and takes time, so the company needs to be sure that this is the real reason to explain why clients have stopped buying this product. Otherwise the company spends a lot and take the risk that customer do not buy their new shampoo anyway. If we take this example and apply the design thinking process to solve the problem, then we start with answering the question “Why did you stop buying this shampoo?”. In this case the obtained answers were surprising, fortunately at the same time, revealed a real problem. Respondents answered that they still like the product’s formula but the bottle is badly designed and leaks. That was the real reason why they have stopped buying it. So the bottle design was the real problem. Instead of investing

time and money into patents, ingredients, etc., it was enough to invest time for asking clients what bothered them, so what they really need and meet their needs designing new shape of bottle.

This illustrates the main role of the problem definition step – find the real problem on the basis of clients' answers and tips, which they reveal during the empathy step (even though we can argue that the real problem of the example above was easily found from interviews and customers' feedback).

How to be sure that we have diagnosed the problem properly? You will never be sure for 100% but you can do at least several actions to discover the most probable one. First, spend as much time as needed to conduct properly the empathy step. Propose proper open questions, do the interview according to the best practice rules (Fig. 2) and immerse if it is possible and needed. Second, in the basis of so collected information build **the empathy map** (Fig. 3). The empathy map can look like this on the figure 3 but also somehow – nevertheless the most important is to segregate all the information you get during the empathy step and write down insight which link to how the interviewees think, feel, hear, see, say and do. You can also put some additional insight which can be categorized as groups: gain and pain. Then group all answers (focus on insights too) and put them onto **the affinity map** (Fig. 4). The groups' names are not defined – the team is going to name them depending on what kind of information did they get and put onto the empathy map. For example: infrastructure, fears, transportation aspects, outlook, financial aspects, etc. Choosing the most crucial problem for solving take into account which one is the most important for the largest number of people – in other words: the most important problem that the solution should address to fulfil the most important customer's needs.

Remember also that the design thinking process is non-linear and iterative, so if you are still not sure or you discover that you have not pointed out the right problem, you can come back to the previous step, empathize again, get new information, facts, insights and define a new problem. It's ok to fail – the sooner the better!



In the problem definition process very important is also to select the proper group of responders after the first recognition. Why? – because you need to know for whom you will solve the problem. Defining “**Persona**” correctly is very important. You think differently and ask other persons if you try to solve the problems connected with Children's Playground, e.g. Than you will consider all the groups of stakeholders, so people who has something in common or influences somehow this place, like moms, children, babysitters and

any other persons who come to this place and use it. But for the problem you are solving, also many other groups can affect, like the city Hall (is an owner and decides about changes and money) or the kindergarten which is nearby and use the playground every day at the same time – they will definitely influence the decisions concerning this place and can be interested in changes your project is going to introduce. So it is crucial for the process to recognize all the stakeholders groups and put them onto the **stakeholder map** (Fig. 5). This tool let you recognize and/or consciously decide for whom, for which group (group = persona, organization, which is like set of

representative features and needs of this particular recognized group) you solve a defined problem – other words – for who your solution will be created. Your “Persona” should be characterized by features such as: age range (e.g. pupils in the 5–12 age range), nature, needs, financial wealth, passions, restrictions, etc., and sometimes also nationality or sex can be very important.

If you know what the real problem is (define problem on the basis of empathy step to whom is directed your project (define the Persona on the basis of stakeholder groups recognition – see the stakeholder map) you are ready to define the **POV** – point of view, so: **WHO? (persona) needs WHAT?(solve some kind of a problem)....BECAUSE?....(the main information and insights from the affinity map)**. The POV is presented in more details in the next section.

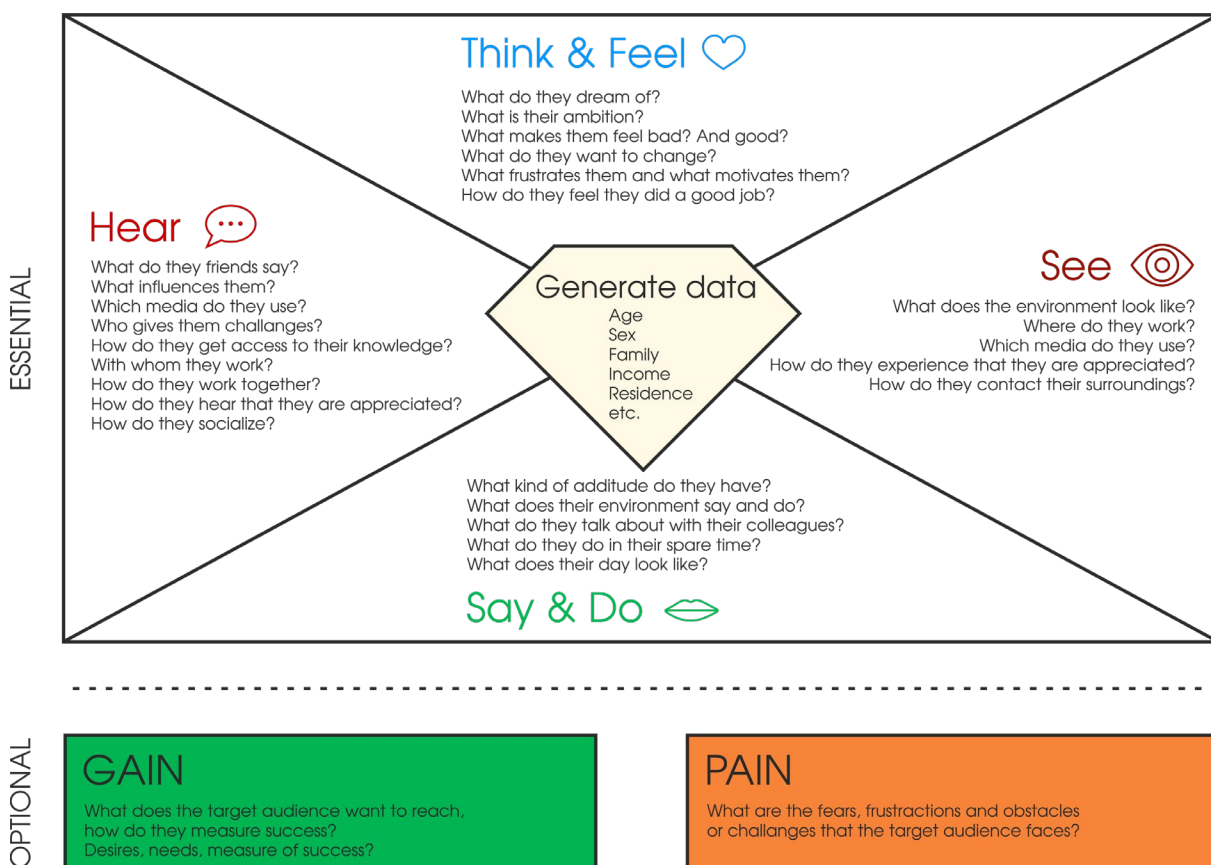


Fig. 3. Empathy map.

More info about empathy map you can find here:

<https://dschool.stanford.edu/wp-content/themes/dschool/method-cards/empathy-map.pdf>

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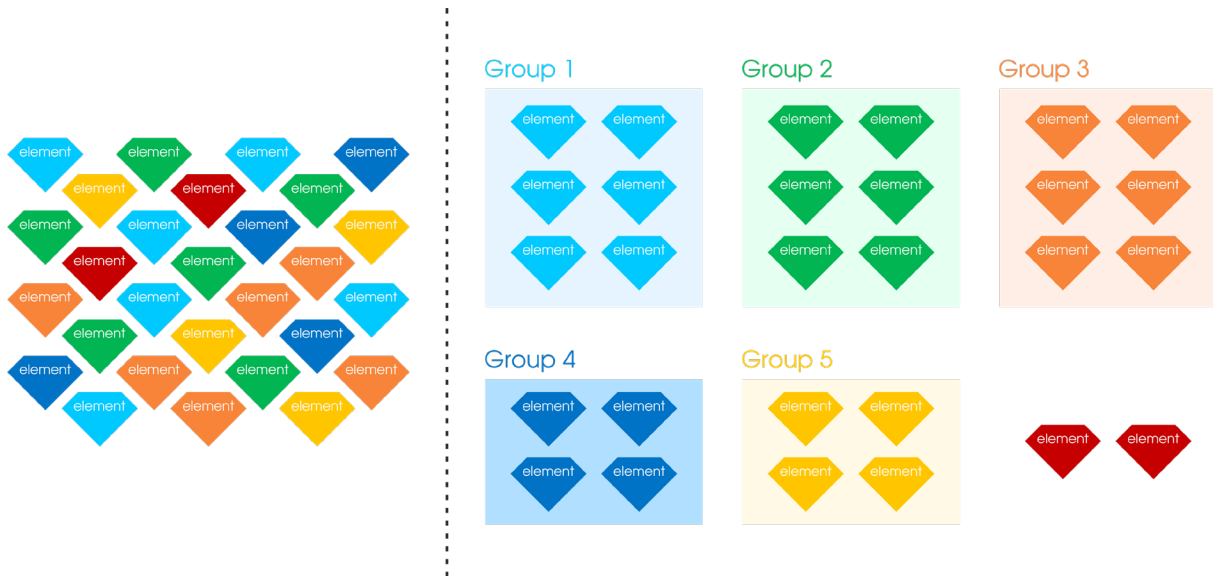


Fig. 4. Affinity map.

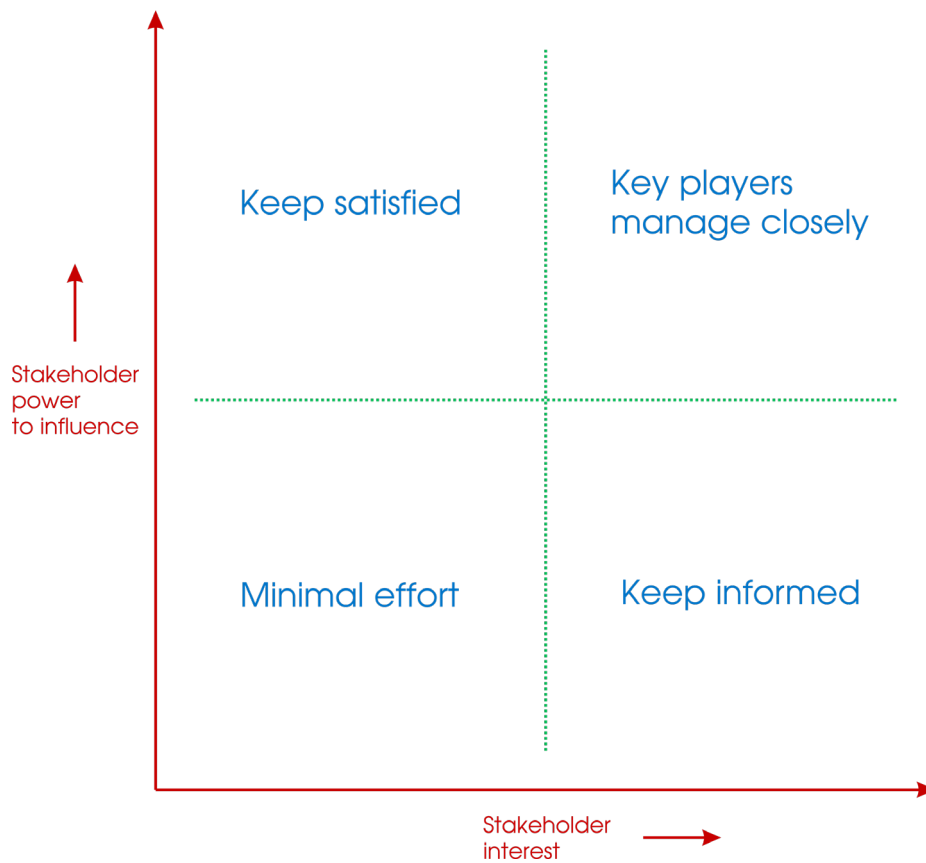


Fig. 5. Stakeholder map.

More info how to build the stakeholders map you can find here:
<http://www.simplilearn.com/effective-stakeholder-engagement-article>

Point of View

A point of view (POV) is the *light-at-the-end-of-the-tunnel* or the *Holy Grail* of the Define/Interpret step that aims at finding the essence of meaning from the myriads of information gathered during the Empathy phase (understanding and observation). In philosophy, a POV is a specified or stated manner of consideration or an attitude how one sees or thinks of something (source: Wikipedia). However, in the case of Design Thinking, this specific statement is composed of three parts with distinctive roles:

The user: because DT is user/human-centered, any specific problem needs to consider the human being as a central part of the process, and therefore the starting point of the POV. However, because the POV aims at reframing the design challenge into an actionable problem statement, it is driven towards users with specific problems. So the description of the users, even very short, should include key personal characteristics that make it unique from others.

The user's needs: again, because DT aims at solving problems, it directly implies that the solution is driven by users' needs. However, these are not expressed in terms of specific tangible needs, but rather express an emotional/mental/physical state, that the future solution will unconsciously foster via its usage. It is therefore recommended that the "need's part starts with so-called non-continuous verbs (e.g. abstract, possession, emotion verbs), and not normal verbs (e.g. linked to physical actions) to express such states.

Last but not least, the POV finishes with the proposition of a so-called "**surprising insight**". In general, if a person has a point of view, it means that some justifications have to be given to support the proposed opinion. In the case of DT's POV, the insight is seen as *a provocative statement of truth that reflects a clear, meaningful perception into human behavior in a particular context* (Jon Kolko). Said differently, it is a justification for the user's need based on abductive reasoning that aims at proposing the best (hypothetic) guess or reason why an observation is occurring.

Table 2. Examples of bad/good POVs

Case	Bad POV	Good POV
Nutrition issues*	A teenage girl needs more nutritious food, because vitamins are vital to good health.	A teenage girl with a bleak outlook needs to feel more socially accepted when eating healthy food, because in her hood a social risk is more dangerous than a health risk. <i>*From d.school method card on POV</i>
Garage experience	A driver needs his/her car to be fixed urgently, because it is his/her only possible transport solution to go to work.	A shy educated female driver needs to feel trust from repair shop, because good and honest diagnostic is a basic condition to keep clients' fidelity.
Stress issues	A kid needs to cope with stress during exam, otherwise he/she has higher probability to fail it.	A primary school kid with stress issues needs to feel school support before exams, because reducing pressure on children shoulders is a basic rule for a more fruitful personal emancipation

How to find POV?

1. Specific user

Usually, it is linked with a persona, i.e. a fictional character whose profile gathers up features of an existing group. This comes from the analysis of the observation made during empathy step and state during definition step. In this way, the persona reflects characteristics taken from this group that, for instance, are related to socio-economical/demographic factors, needs, desires/hopes or cultural background.

2. User's need

Empathy map coupled with Affinity map or finding relationships between key observations and building a skeleton of thoughts using concept map can reveal what the user intrinsically needs. Besides, this can directly come from group's observations and discoveries.

3. Surprising insight

One proposed solution to find an insight, is to use abductive reasoning like detectives. Knowing a premise that comes from you observations (this can be the result from affinity map or concept map, or simply the user's need which is defined), you can interpret or explain such evidence by asking a "WHY" question. If the answer is too vague, or does not create enough satisfaction in the way it is articulated, use the 5 WHYS method (Sakichi Toyoda) to reach the root of the problem. The insight will be a reformulation of the explanation, which by essence should fulfil the following 6 "criteria":

- be authentic: it comes from your personal judgment,
- be non-obvious: or not too simplisitc, caricatural,
- be revealing: when reading it, things make sense,
- inform: especially give meaningful perception of human behavior in particular context,
- inspire: since the POV is also the starting point for Ideation step, its formulation should foster creative thinking,
- be memorable: shouldn't be too long to be remembered easily.

POV is like an end point of the long and difficult step of empathy and at the same time the starting point for new solution creation – do not save time on formulating it. Finally, it is hard but crucial to give up and end the POV even if you are not sure about its correctness.

TIPS

- ◆ Because reflective, it is advised to do POV individually
- ◆ POV can be demanding to formulate and be a long process. Never give up!
- ◆ Organize team discussion, where everybody present their POV for common decision.

TIPS



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STEP 3: Ideation

Ideation is a significant stage in whole process of design thinking and together with previous stages make the DT process consistent. The significance of the ideation stage results from the fact that without this stage DT process cannot go further and to process this stage material gathered from previous stages is needed. **Ideation** should be considered as a piece of bigger process because also this stage generates valuable materials and ideas. This is important for mentors and other participants of the project to perceive it that way because it helps to organize process of thinking and work of whole project team.

Ideation is the process of creative thinking. This is the point of the process that gives a live to new ideas or solutions for the project. This is crucial moment of deciding about how to use all knowledge about the problem gathered from the end user in **Empathy** stage and how respond on defined problem for which solutions is searched.

Three important things should be in mind while starting the **Ideation** stage:

- **end user (persona)**, for whom we design the solution. It is important to refer to data collected from the end user at the **Empathy** stage because it should be remember that our ideas should help to solve the concrete problem and change or have a big influence on the life of particular user.
- **defined problem**, which was determined by the team in previous stage and on which they work now (summarized and written in the form of POV – point of view);
- **awareness of the whole design thinking process** and the role of the **Ideation** as an it's part which should include and refer to the data gathered in the process of **Empathy**. This awareness helps to define what and for what reason things are done.

Taking under consideration mentioned aspects while creative work of the team will provide for the best possible fulfillment of the objective.

Ideation often seems to be most simple and an easiest, most creative and sometimes even trivial element of the process puzzle. It's believed to be unlimited for creating new solution and whatever is possible in every possible way. Practically ideation is not so easy and simple and trivial as it looks like. To achieve real creativeness of the team and their work there should be no fettering factors. Furthermore there is a need to build the specific atmosphere which could foster both the creative individual and team work because this ensure the freedom in generating solutions. For project team is important to feel that there are no limits in process of creating, that even loony looking idea could be real and essential for the process of finding solution on the problem on which team work on.

To achieve good efficiency in the process of creation many elements that are composed on that process must be remembered. Here it must be admitted how underestimated the work of DT mentor is and how his work can influence the effectiveness of the project team. The atmosphere in the team should be under his control furthermore he should observe the work of each member of the team separately this allows him to appropriate moderation of team work. Otherwise this stage could became the hardest moment for the team and in the worst case cause the loss of confidence in effect of own work and finally in whole design thinking process. This situation provokes questions “does it make sense at all?” or “what is the reason for doing this or that?”.

Mentor should be aware of that the mentioned situation and question can come and his role is to avoid those situation by working at the backstage of the team during the design thinking process. Difficult moments are regular feature and at this level will happen but awareness of this helps mentor to respond appropriately and carry out the team through those moments and go to the next stage. Team is a brilliant machine but it has one weak point – people. People form the team and as anybody else they have bad days, doubts, they can be tired or absorbed by their personal problems. That is why sometimes the best remedy for a difficult moment in team's work is to do break. Sometimes few hours for break is enough but sometimes few days of rest is needed.

So what is the **Ideation** process? How to find the WOW?

The aim of IDEATION process is to generate the best solution for the end user needs.

That is how briefly this stage can be described but to achieve it set of several components and tools which helps to work out the solution is needed.

During ideation stage alike running DT process is important to have it in mind that there are no simple algorithms or strictly defined sets of tools which will assure us that starting from point A we reach point B. It should be rather presented as a map. Map which gives information about different routes leading to destination point or sometimes to various points and sometimes even leading beyond maps contour. There is no reason to be afraid but it should be kept in mind what is the reason for doing this. Mentor and entire team determine how quick they will move and which route they will choose keeping in mind what they need to achieve during **Ideation** stage.

It was said that different paths can lead to a solution for defined problem. To illustrate it problem of delivering food from one side of a river to another can be shown. There is no one good way to solve it because food can be transported in a wooden boat or by swimming with a sealed bag. Crossing rope or even rope bridge alike wooden footbridge or wooden bridge which will give opportunity to use a car can be build. It is possible to build steel bridge for a lorry full of food or a motorway bridge which will enable several hundred lorries per hour to cross it. Helicopter or even airplane can be used if two airports at each side of river will be build. Those examples shows that there is infinite number of solutions. This is what **Ideation** process really is – inventing, creating new things and connecting of ideas. At early stage of **Ideation** there is a place for lots of ideas and solutions while going further they start to be more realistic and number degenerate into a quality. Over the time there is a need to draw attention on the limitations that exist or are imposed by our client or even end user and only those solutions that meet our objectives are chosen. Basing on the described example of a process of food transport across the river for which some solutions were generated is important to remember that everything should refer to financial capabilities, time or the capacity of road connection. At this point any detail starts to be crucial for this process like the information that on one side of river lives family. Basically it could be treated as a trivial information but that could eliminate lots of proposed solutions and process will focus on idea of swimming with sealed bag because it will be the best and most optimal. Of course family could be resettled on the other side of the river and then there won't be any problem with food transport.

On one hand ideation is complicated and on the other hand is most fluent and elastic stage from whole design thinking process. At this stage cooperation inside a team is the most crucial element. There are no other possible moment in further steps of DT process that gives opportunity for a team members to cooperate between each other so close. It is fascinating to observe the process

of generating ideas when they came out of nowhere, arise at the same time, sometimes are built on others ideas, sometimes just one word uttered by a coincidence or in a different context by one team member can be a spark for different idea for other member. Sometimes a random spoken word can become the beginning of a new chapter in the process for the team and then everything that happened before, does not matter, because project has just entered on a new path, new route just been found on the map. Those are most valuable moments in the process when the new path leading to destination point has been found. Only enormous mental and personal engagement of each team member, their consistent thinking creates work atmosphere and let them find this moment – moment of WOW!

To prevent this stage of ideation against possible disruptions both technical and physiological aspects must be secured because they guarantee an efficient work comfort. For each of them list of components can be attributed about which team should remember but it will never be closed list and should be customized individually by project team.

Technical aspects include:

- **appropriate workplace.** Not without significance is its size, adapted to the size of the team and type of project. Preferable with a large access of fresh air.
- **natural or artificial lightning.** Room should be lighted using natural light which is most optimal but in case of long work of the team sometimes necessary also to use artificial source of light. It shouldn't be fatiguing for vision or concentration (a.e. by loud noises, buzzing lights, which can be very annoying);
- comfortable and convenient furniture which can be also inspiring;
- **technical support materials** such as bulletin boards, flip charts, markers, fine liners, pens and pencils, adhesive sticky notes in different colors, sizes and shapes, strips, tack adhesive pads,
- **inspiring elements**, such as photos, colorful magazines, small gadgets, not necessarily related to the topic of the project but can inspire in search of solutions to a specific problem,
- **access to equipped social area and kitchen back.** It is worth remembering that thinking is very energy consuming, so team members need to provide your organism energy.

Psychological aspects include:

- **working comfort of each team member**, among others through providing equal access to speak,
- determination of **common rules for work**,
- **a clear timetable for the team**, which also needs to be flexible, because of the creative process, which should not be interrupted. For example, if during the process, it is found that the creative process should not be interrupted it will be necessary to extend a certain stage, but sometimes it will be possible to shorten the duration of the other due to a. e. fatigue syndrome,

- introduction and clear presentation of tools with team is going use,
- adaptation of individual roles in the team in relation to the features of character of people in order to achieve a high level of comfort and efficiency.

These aspects will be important no matter what specific techniques and tools the team will use to work on the **Ideation** stage. The point is to eliminate barriers while seeking of good ideas or even stimulate a team to generate good ideas in large quantities, because it is the goal of this stage. All possible resources and forces on which we can afford in a given project to create an atmosphere of creative, comfortable work should be involved.

Depending on the size of the team, subject, time, and other factors that are variable in each project in order to effectively go through the stage of ideation, you can use many different tools. Of course, each mentor should have its own set of proven tools that can effectively use. It's better if he know much more tools and what more he know how to use them. It should however be noted that it is better to have a ready 6 well-prepared, known tools than 30 random, so that both the mentor and the team won't get lost during the work. Improper, untested tools, easily knock the team out of the rhythm of creative work and cause rapid discouragement. Brainstorming –one of the most popular exercises used in **Ideation** session for generating ideas has been described below. However, for this stage, there are many tools to help stimulate creativity and team members to almost endless process of inventing. Several additional tools such as. "Yes but, yes and", are described in Toolbox'ie.

Brainstroming

It is one of the most popular tools for creation a large amount of ideas. Brainstorming session might look different, and the following diagram can be freely modify by adapting the tool to the needs. The session begins with the explanation of the rules and to get familiar the team with workplace. Please be aware that the team members should work standing up and each of them individually have their own set, post-it notes and something to write with. In practice, pens with the not too thick tip are useful. Standing position plays important because it has a very large impact on the quantity and quality of ideas engagement team members at work. Standing position is very important here, because it has a very large impact on the quantity of ideas and quality of engagement team members at work. It has to do with a better blood circulation and body language in communicating ideas to other members of the team.



The challenge is that in a certain, relatively short time, each team member individually should write on pieces of the greatest number of ideas and solutions to the problem on which we are currently working team. Only one idea on one sheet. Due to the fact at the later stages of brainstorming ideas can be freely moved on the board, you can assign them, for example, to certain groups of solutions. It is good when the other side of the sheet is signed by the author of the idea. Sometimes it is useful that author explains in greater detail his idea to the team. It is important to schedule the time after each session of individual work for a presentation of the

The challenge is that in a certain, relatively short time, each team member individually should write on pieces of the greatest number of ideas and solutions to the problem on which we are currently working team. Only one idea on one sheet. Due to the fact at the later stages of brainstorming ideas can be freely moved on the board, you can assign them, for example, to certain groups of solutions. It is good when the other side of the sheet is signed by the author of the idea. Sometimes it is useful that author explains in greater detail his idea to the team. It is important to schedule the time after each session of individual work for a presentation of the

concept to the whole team. This will allow you to connect similar, repetitive ideas from the various team members. The exchange of information is very important. Thanks to it each team member will know all the ideas and be able to inspire in a next session of generating ideas by building new ideas on old ones. How many of these sessions will be held it depends on how much time will be designated to this task. An example would be planned four sessions for five minutes of work and time for the presentation between sessions around five to ten minutes. Carrying out several such sessions consisting of individual work and teamwork, allows the team to generate hundreds of ideas. Then the time for calm analysis of the generated ideas and grouped them should be planned. Very good practice during these sessions is a good documentation of the entire process - for example, by photographing the progress of work. This is the fastest and easiest way to backup. Thanks to this at any time you can go back to all the ideas generated at various stages of work.

Remember that the foregoing description is only an example, which can be freely modified and adapted to the work of his team.

Summary

Ideation stage is a complex and difficult stage having a huge impact on the final solution to the problem. With properly prepared work schedule and tools that will be used and a good team, this step can be not only very effective and gives a lot of energy to all its members, but it can also be very pleasant creative work.

At the conclusion one more very important thing worth paying attention – it should be allowed any person who participates in this stage to develop. It is the sum of the energy of individual team members which gives the energy to create great things. It is therefore important to cherish every manifestation of commitment and creativity. This will be the foundation on which the team will build new solutions for a given problem. To see the importance of sensitivity to the activity of each member of the team, you should see the speech by David Kelley, one of the creators of the whole process of design thinking who speaks about it. The role of a mentor at this stage is invaluable.

https://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence?language=pl

TIPS

- ◆ Everyone in a team should work in standing position, because it stimulates the creation process of thinking (better circulation of the blood, power of body language, etc.).
- ◆ Space arrangement should include keeping enough space to move freely, it will create better condition for thinking (many people claim they do their best thinking while walking).
- ◆ Each participant should generate ideas alone then it will be discussed at the forum. This situation will result in the ability to generate new ideas with existing ones.
- ◆ Motivating music for working played in background (if nobody minds).
- ◆ Mentor/tutor should keep an eye on the time.
- ◆ Writing on post-it's with permanent marker, in capital letters. Everyone keep in his/her hand writing pad and marker.
- ◆ If it is not possible to leave post-it's on whiteboard/wall for the time of project, the best solution is to use "mobile surface" (like huge piece of brown paper or flipchart).
- ◆ Spontaneous questions from mentors on current progress can help steer work of team members.
- ◆ It is suggested to conduct relaxing warm-up before an ideation session.

TIPS

Read more...

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Krzysztof Jastrzębski

STEP 4: Prototyping

One of the most crucial aspect of working with a potential new product or solution to the problem is to give the opportunity for the user to experience it. After the ideation phase a few abstract ideas (sometimes the solo one) from the dozens of primarily investigated should be already crystalized in their form. **Prototyping** allows a deep exploration of selected concepts. In that way, different aspects of the presented object, situation, etc., can be evaluated on the spot. What is more, feedback that is received during prototyping phase itself and future testing should help to improve the final result. From the business point of view, prototyping enables to save time and resources before introduction to the market of the not sufficiently refined concept.

Depending on the level of advancement in the work towards commercialization of the developed solution, various types of prototypes are prepared. The first attempts to prototyping can begin with just a sketch that can be done on the napkin during coffee break. Further elaborations usually result in the constructions that can be presented to the limited audience after a couple of words of explanation. Finally fully operational prototypes are designated to the true field tests.



At the early stages the best solution is low-resolution or low-fidelity prototype. It means that the impact is put on fast creation to show the general idea. In that type of constructions, there is no need to introduce expensive and sophisticated materials and technologies, instead, cardboard, styrofoam etc. are of great interest. Next generations of prototypes are becoming more and more detailed and resembling the final product or service to higher extent. **Prototyping** is a term easily

connected with tangible objects because it is possible to build them, rescale or model. Nevertheless, also any type of services, the whole events, computer or mobile applications etc. can be visualised and prototyped. Simple graphics can be treated as the most primitive prototypes.

For human brain it is easier to focus and understand images rather that descriptions. What is more, any type of visuals enables to put their potential receivers on the specified (to some extend) tracks since one image can replace even very complex description. To prove it, just think about the statement “red vehicle”. First of all it is not very specific, the two words can be decoded in many ways. Vehicle can stand for a car, bicycle or even a tank. “Red” can be related to various shades of colour. Secondly, such statement is rather neutral. Some of us can think about big 18 wheels track or children’s toy, but it will be rather hard to give any opinions about it. On contrary look at the picture presenting “red vehicle”(Fig. 6).

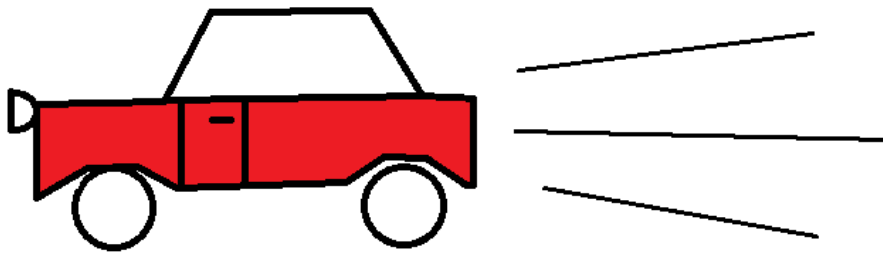


Fig. 6. General visualisation of statement “red vehicle”.

Of course the graphics that was created in just few seconds can be decoded in many ways but still person looking at it can mention many aspects of it:

- “It is a car”
- “The car has a lamp”
- “The car has single doors”
- “The car has two axels”
- “Its front is shorter than its back, it looks strange”
- “Super speed car!”
- “I prefer more pale colours”
- “Oh...red car it must be a sport car!”
- “The jeep would be nice instead of that sedan”
- “That car lack of many important details like: CB radio antenna, ruck for bicycles etc.”

By considering even just the above statements, we can draw several conclusions about the people that say them. For example:

- We can feel the preferences in the field of car type (jeep instead of sedan).
- The colour of car can identify that it is probably a sport one.
- Some people travel by car with bicycles.

For the purpose of prototyping applications in low-resolution, usually a series of graphics can be used (**Fig. 7**). Each image (commonly placed on the separate piece of paper) represent in that way a screenshot of the interface changing according to the expectations of the user.

To improve the possible interaction of the user with the concept, developed as a result of for example DT process, visualisation should not end up with just graphic but also involve 3D models, scenes, videos, etc. Non-material prototypes are especially important in case of working with services. In some cases, preparation for the tests will require planning the conversation or its surrounding (like smells, music, colours).



Fig. 7. Visualisations of mobile phone screen.

There are few golden rules that should be considered before attempting prototyping:

- **Make something** – prototyping phase requires action and not thinking over the whole concept (time for that was during ideation or will come with next iteration). Do not focus on selection of the materials, overall size etc. Just start DOING. The advantage of low resolution prototypes is that they can be easily modified or even quickly rebuilt so do not lose time for “over-creation”.
- **Just a tool for testing** – prototype itself is of rather low value but important is how other people react with experiencing it and what can be driven from such knowledge.
- **Creator is the first tester** – by creating the prototype each person also experiences it. Remember to take notes considering improvements or changes in what was already done, just after the prototyping phase is finished.
- **Key features** – low resolution prototypes should present the general idea, but still its most important features should be emphasised. In case of any prototype it will be different, sometimes it will be even a colour or feature.

TIPS

- ◆ Do not focus on selection of the best fitted materials, overall size etc. Just start DOING!
- ◆ Do the low resolution prototype, not lose time for “over-creation”!
- ◆ Take notes considering improvements or changes in what was already done!

TIPS

Read more...

Experiment mixtape: advancing your solution via prototyping. Institute of Design at Stanford.

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The Skeptic's Guide To Low-Fidelity Prototyping.

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Usability.gob – Prototyping

<http://www.usability.gov/how-to-and-tools/methods/prototyping.html>

High- and Low-fidelity Prototypes

<https://visualhierarchy.co/blog/the-continuum-of-high-and-low-fidelity-prototypes/>

The Top Rapid Prototyping Programs And Techniques For Designers

<https://www.elegantthemes.com/blog/resources/the-top-rapid-prototyping-programs-and-techniques-for-designers>

Method cards: prototype to test

<https://dschool.stanford.edu/wp-content/themes/dschool/method-cards/prototype-to-test.pdf>

Prototyping Tools and Techniques

<https://www.kth.se/social/upload/52ef5ee4f2765445a466a28a/mackay-lafon-prototypes-52-HCI.pdf>

Types of Rapid Prototyping

<http://es.slideshare.net/nurhudahayati/types-of-rapid-prototyping-additive-process>



Alexander Utne

STEP 5: Testing

When you have your prototype, it is time for **Testing**. The testing phase is in many ways an extension of the empathy phase and the goal is generally to learn whether your educated assumptions and estimations are in any way, shape, or form correct. For this stage, the prototype is your most valuable empathizing tool. You want to learn even more about what your users want, if they feel the same pain or gain (**Fig. 3**) that you have previously identified, and if your solution helps with that.

The further along the prototype is the better it becomes a tool for learning from customers. This is however a double-edged sword. On one hand, you want your prototype to be as close to a finished product as possible. But at the same time, you want to get it in the hands of your users as fast as possible. Often, people wait too long before they show the prototype to users, and this can lead to wasted effort. For every hour you spend building or tinkering on your prototype, you could potentially be building something useless, e.g.; you are building something that users don't want. So the recommendation here is to get out and test your prototype sooner rather than later. On the other hand, the better the prototype the better your test could be. The more realistic and close to a real product you prototype is the easier it is to test on users. 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. There are many ways of helping users through this experience. Sometimes you might just want to give them the prototype and observe what they do, other times you might want to guide them through the experience of using it.

For example: "Imagine you are sitting in your tent, the rain is porting down outside, you and your clothes are soaked and you are freezing. In the bottom of your backpack you have X prototype that can instantly turn the water in you tent to heat and do so and so. How would this work for you as a camper? How would you use it? What about the size? Shape? When would you use it? Could you imagine a way for it to work better? What do you see not working? Do you see any other areas it could be useful? Do you know of anyone else I could talk to about this product? Could I contact you again then the product is more developed to talk more?" It's always a good idea to get contact info from new interview subjects and the option to contact the person again. These are some examples of questions to ask when a person is testing your prototype, and remember they are doing you a favor when talking to you. Do not try to defend your work, if they criticize you or the prototype that's fine. You are the designer and expert here, and if they don't like it, it might be because they are correct or they might be disrespectful. In both cases, absorb the information, say thank you and move on. There is nothing to gain for you by defending or arguing why you are right. Still, you should always make sure you are on the same page and that the tester understands you and the prototype correctly.

Interpreting tests is an important part of the testing process. It is important to understand that the wisdom of the crowd is greater than yours. However, you are the designer, you are the expert that sits on all the information and you're in charge of creating x solution for the user. Listening to users does not mean that you should do exactly what the users tell you. It means listen, reflect and understand what that means. Think of the famous quote by Henry Ford "if I asked what people want, they would say a faster horse". The point is that people often answer problems with a direct

solution. They might say I want a button to turn that thing on or off. Then it's your job to think that function needs to be turned on/off, but does it need to be a button? Does that function even need to be there? The user doesn't always have the holistic perspective you do, so it's your job to listen, but always keep in mind that you are the designer.

There are many kinds of different tests and the segment above have been focusing on user/customer testing in early stages. Sometimes it is necessary to test for pure functionality. Here the same principles apply. You want to do your tests as early as possible and in a real life environment.

In later stages when your prototype is starting to look more like a product, you want to move in the direction of qualitative testing. We won't focus on that in this section. For more info on qualitative testing Lean Startup is an excellent tool. The Lean startup by Eric Rise is a great book to start learning about the topic.

In many ways, the final testing takes place when the product/service is in the market, and sales is the ultimate feedback. The smartest companies also make sure to keep iterating and improving on their products, even those products that are established in the marketplace, and with that mindset you could argue that the testing phase, and the DT process as a whole, never ends!

TIPS

- ◆ Testing should be carried with final user participation (a solution is created for him!).
- ◆ We should avoid explanation when we give the prototype for testing. The best for user is to learn how to use it based on his own experience.
- ◆ We go to places where we meet many potential users.
- ◆ During testing we can get back to the place where empathy was done.
- ◆ The best approach is to present prototype in pairs or threes, not to scare the user.

TIPS

Read more...

Testing overview and black-box testing techniques

<http://agile.csc.ncsu.edu/SEMaterials/BlackBox.pdf>

Black-box vs. White-box Testing: Choosing the Right Approach to Deliver Quality Applications

http://www.cs.unh.edu/~it666/reading_list/Defense/blackbox vs whitebox testing.pdf

BEFORE YOU START...

Anna Laska

There are some more tips that you might find useful during implementation of DT in your classes/projects.

- ◆ Students should know the framework schedule at the beginning of the course/ project.
- ◆ Students need to know who is a mentor/tutor and how to contact him/her in case of any questions.
- ◆ It is helpful to set the rules – prepare the contract (e.g. be punctual, eating/ drinking allowed/not allowed during meetings, rule 1/1/1 – one person at one moment about one thing, mobiles not allowed – looking at mobile instead of working with the group lower the potential results).
- ◆ Remove formal barriers between project team members – everyone talks to each other per thou. It lets them know to each other better and provides more friendly atmosphere to work.
- ◆ The size of the team should not exceed 8 members (optimal is 5 or 6).
- ◆ All team members should work together from start to finish, through the whole process of the project – changing roles in a team can help sometimes to engage team members better.
- ◆ It is helpful to present case studies carried out by team or by mentors (present your/known experiences).
- ◆ Prepare the presentation (if needed) with many pictures (they make it more attractive). Pictures that well match to the content make facts/exercises more memorable. Do not write elaborates on the slides ☺ Keep in mind: the less the better.

Vedlegg 3 - Toolbox



TOOLBOX

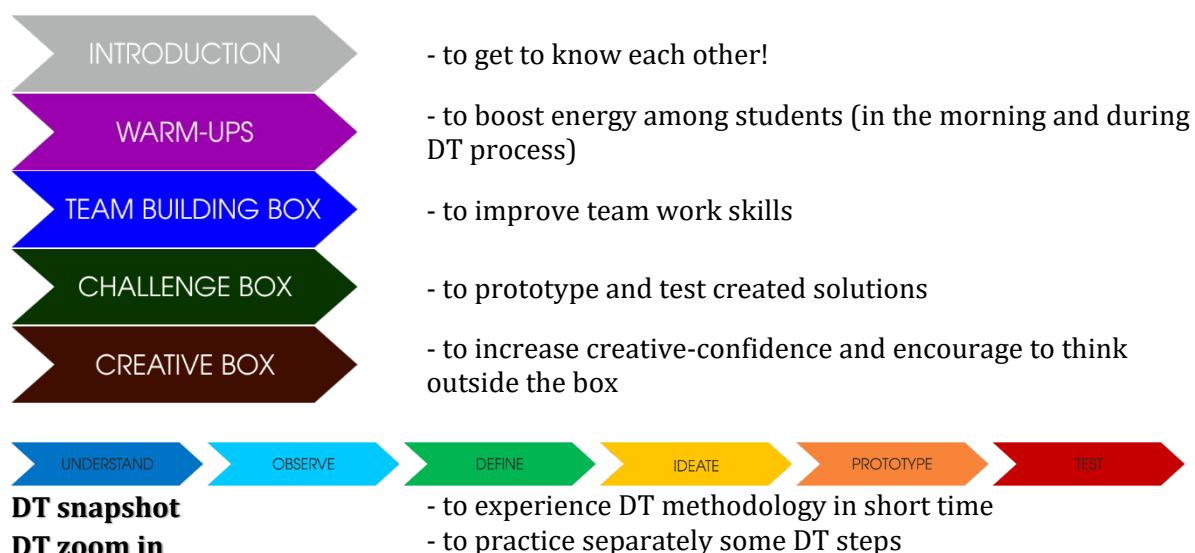
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HOW TO USE DT TOOLBOX

The **TOOLBOX** is divided into several sections. Each section includes exercises for students that may be used during DT course/ workshop/ project. There is a wide range of tasks, which leads to develop different skills, not only directly connected with Design Thinking process. Being creative and open-minded, involvement in team work and FUN are essential to achieve a success with DT methodology among students!

DT Toolbox sections



To **DT Toolbox** additional materials are attached, such as: presentations, worksheets and movies. Lists are presented below.


List of Presentations

- Presentation_1: DT snapshot 
- Presentation_2: Lifesaving SAFARI
- Presentation_3: Village WORLD
- Presentation_4: Candle Transport Challenge
- Presentation_5: Line Game

List of Worksheets

- Worksheet_1: BINGO 
- Worksheet_2: DT snapshot
- Worksheet_3: Lifesaving SAFARI
- Worksheet_4: Apartment challenge
- Worksheet_5: Village WORLD
- Worksheet_6: Line game
- Worksheet_7: 30 Circles

List of Movies

- Movie_1: Yes, and... 
- Movie_2: Candle Transport Challenge
- Movie_3: Basket Tennis Challenge
- Movie_4: Ballooning Egg Challenge

Let's know each other!

The beginning is said to be difficult and hard. First meetings as something unknown and new may bring some difficulties in communication between people. At the beginning of the DT course it is worth creating friendly atmosphere and conviction that everyone can express oneself with respect to our differences.

There are many exercises that can be used in order to get to know other. There are some which you may successfully implement during your classes.

1 Prototype your name

What do you need?	colourful papers, markers, plasticine, crayons, tapes, lace, wires, ropes, etc.
Instruction	Prototype your name
Time	3-5 minutes (it depends on how many materials you have)
Comment	Participants may use prototyped name during whole 1 st day of classes/workshop, then they may just write their names on sticky papers and pin to T-shirt.

2 Express oneself

Express oneself is an easy exercise that can be done to get to know each other at the beginning of DT course/ workshop. The aim is to present oneself in indirect way (avoiding just a simple introduction).

There are many different versions of Express oneself, don't hesitate to test your own with the students. Two tested and good-working versions are presented below.

Version 1.

What do you need?	Lego (normal bricks or for smaller children e.g. Duplo)
Instruction	Take 7 bricks and build something that expresses yourself somehow. Then you have to present your creation and yourself. Start the presentation with "I'm ... This is what I've created..."
Time	4 minutes (choosing bricks and building) + short presentation of each participant (around 45 seconds, sometimes longer)
Comment	Allow everyone express oneself for as much time as he/she needs. Asking questions is also possible, but try to do it after student's presentation (don't interrupt the speech). It may be good idea to clap after everyone's presentation (if participants feel comfortable with it)

Version 2.

What do you need?	Postcards from different places (countries, cities, landscapes, animals etc.) – the bigger diversity, the better
Instruction	Choose 1 postcard that you like the most/ you find the most attractive or interesting/ has attracted your attention. Then introduce yourself and the chosen picture with some explanation.
Time	3 minutes (depending on size of the group) + short presentation of each participant (around 45 seconds, sometimes longer)
Comment	Give a wide selection of postcards, but remember to limit the amount of them (neither few nor many, max 2 picture per person). Allow everyone express oneself for as much time as he/she needs. Asking questions is also possible, but try to do it after student's presentation (don't interrupt the speech). It may be good idea to clap after everyone's presentation (if participants feel comfortable with it).

3 BINGO



BINGO can be used to know more details about the participants – what they like and dislike, how they spend their free time and what abilities they have etc.

What do you need?	BINGO worksheet (Worksheet_1), small square papers to write the name on it, box/small basket
Instruction	Get to know other participants – ask them questions about things mentioned in the BINGO chart. Fill in the chart with names of other course participants, who confirm statement from single box. Each participant can put name of one person just in 3 boxes. One name in one box. The whole BINGO chart should be filled in (it means the greatest chances of winning). After set time the conversations should be over. Then all participants write their names on square papers, fold it and put in box/basket. The tutor chooses randomly paper by paper and reads aloud the name. Students mark each box where there is read name. To get a BINGO must make a horizontal, diagonal or vertical line.
Time	10 minutes to fulfil BINGO chart
Comment	Be sure that participants understand the rules before they start conversations. You don't need to tell them about BINGO rules before the conversation part. You can divide the instruction into two parts – (1) instruction to conversation and putting names in the BINGO chart, (2) instruction to BINGO.

Again, **Queue** gives tutors many possibilities. The exercise can be used at the beginning to know more about course/workshop participants but also may be treated as a short break during DT process.

What do you need?	Some free space (enabling participants to stay in a one queue)
Instruction	Queue up! Examples: <ol style="list-style-type: none">1. What is your favourite food? Queue up from A to Z!2. Where do you dream of travelling to? (name of country) Queue up from A to Z!3. What is your hobby? Queue up from A to Z!4. When the participants are already queued up, ask them about their answers.
Time	1 minute for each round
Comment	Encourage participants to ask questions to each other and to queue up as fast as possible. You can add the exercise as a method to divide the group into twos or threes. Just when you have a ready queue ask them to count to 2 or 3.

UNDERSTAND

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DT SNAPSHOT

The exercise provides the ability to experience the full cycle of design thinking process in a very short time without a prior theoretical knowledge of the method (Worksheet_2). In some cases it is worth to carry it before the theoretical explanation of the various stages of the DT methodology. The exercise must be performed in pairs. Each person in the group needs only a pen and a space to take notes. You should also ensure for groups adequate conditions for comfortable conversation. An important element of the exercise is the rigor of the time. Keeping assumed operating times for each step is an important rule in this exercise. However it is possible to lengthen a time, depending on the abilities of a project group and specificity of project. In the exercise, the work of both participants is alternating. This gives the ability for them to act both as the leader of the process - the designer, and the recipient solution - the customer. A valuable addition to this exercise is the background music, which may be started when exercise starts in both: pairs work and individual work. We should adjust the volume to the specificity of a given process step and the overall room conditions. Working time should be measured out with a dedicated stopwatch and the end of the stage should be announced by a loud signal: siren, bell, etc. It is strongly advised to explain a project topic only before starting the exercise. We do not need to introduce to participants main steps of the exercise as well as we need to introduce the rule of holding off from viewing of all following sheets of the steps of exercise. Another valuable tool to support this exercise should be a multimedia presentation showing and explaining every step of the DT process and appropriate sheets of exercise during their filling. In addition, the presentation slides will help conducting an exercise while explaining the various steps and mechanisms of design thinking process.

1. Empathy – interview your partner and get as much information as possible

During the first step of the DT exercise a participant has to interview a partner and he is interviewed in turn as well. It is worth to announce the initial division of the groups as first: who is a "Partner A" and who is a "Partner B". This will facilitate the trainer proper signaling and initiating working turns between empathy step exercise participants. The purpose of this step is to try empathizing with a partner to gain as much information about him, about his life, needs, desires, etc. This is crucial when we have to design a best solution for the other person. Both participants have four minutes of time to learn as much as possible about their conversationalist. After 4 minutes the change of the interviewer must be initiated. An important element of this interview is properly formulated question. The questions should be asked in open style and it should allow exploration of various paths and directions of the interview. It is preferable to start the question with "Why?" instead of "Do you?".

2. Empathy – interview your partner again and get more information

In the next step of the exercise the participants will have a second chance to deepen their knowledge about the partner by asking additional questions. You should clarify to participants that it is a great opportunity to return to interviewed partner and ask new deeper questions: about new directions, those that have just appeared in the first interview, but also to re-explore existing topics. It is allowable to make a 45-second break between two rounds of interviews in order to enable participants to plan and define further questions.



3. Empathy – capture, analyze & summarize you findings

In this step participants practice DT process individually. The aim is to start the problem definition stage (Point of View role and its importance should be clearly explained to participants in the beginning of this exercise) by making a summary of the information that has been recorded in the course of two interviews. In the top of the exercise form the participant should write down his observations and findings captured during two interviews. He should also note the goals and desires of his partner. It should be emphasized that the description of objectives and desires needs using verbs, example: 'it points out ', 'it uses ... ', 'I feel better when ... ' " He sees the need for use ... ", etc.

4. Definition – take a stand with Point of View of you partner

This step is a continuation of the problem definition (POV) stage. The exercise participant, working individually, identifies and selects a problem or a need from the stored knowledge base which, in his opinion, is the most important for his partner. A need or POV has to be defined in the form stating whom it is defined for. The most common solution in this exercise is writing down a name of our partner. At this stage a POV should be defined briefly and concisely but is should keep the essence of the problem: "**John...needs a way to ... avoid chaos associated with buying gifts for Christmas**". In addition, we can define a POV by providing some additional reasons: Because / But / is surprising that ..."**Because ... he has a large family and he has a backlog of duties at work before Christmas.**"

5. Ideation – sketch at least 5 radical ways to meet your partner’s needs

Having user’s based POV defined an exercise participant will have to start to generate (sketch) five ideas in five available boxes. It is really important to point out that drawing pictures is always much more valuable than using descriptions. The sketched ideas might be simple but it should deliver a working solution of a problem or a need defined by POV. To make this process more efficient the participant should rewrite his POV into the field above the ideas boxes. This allows him to observe a POV constantly and focus on the creative drawing work without wasting time by looking back to another exercise sheet page. It is worth encouraging exercise participants to be creative and radical, to go out of the box and to be courageous in sketching. The trainer may also encourage participants to generate a full set of five solutions as fast as possible.

6. Ideation – share proposed solutions & capture partner’s feedback

In this step exercise participants will return to work in pairs. Participants describe their partners generated ideas and obtain a feedback from them. This information should be recorded in proper place in exercise form. The essence of constructive criticism and its impact on the quality of the final solution should be emphasized here. You should encourage participants to not afraid to criticize and be criticized as well. They also should point out shortcomings and discrepancies between solutions and their own vision of the needs that they have to satisfy. An exercise participant who is presenting his solutions must record a feedback he gets, which will allow him choosing the best solution from the point of view of his partner, improving it or finding a new, better one. The feedback obtained in this step can also help designer to update and improve defined POV.

7. Ideation – design a new solution based on captured partner’s feedback

Having obtained feedback exercise participants has to back to the process now and create the final solution. They should try to include as much details and technical additional descriptions as possible. The solution sketch and its descriptions will be the guide to build a real 3D prototype. In a situation where the time limitations and working conditions do not allow carry out full prototyping session it is possible to present a drawn solution together with the proper comment – we can name it as 2D rapid prototype.

8. Prototyping – build your solution

This step of prototyping must be performed using materials and tools available in the class room or lab. We encourage participants to be creative again. We keep them in mind that a prototype, its functionality and details must reflect the functionality that solves a problem and meets a need of the recipient. It is worth to prepare sort of exhibition of prototypes. In this step you can adjust the time of the exercise to the classroom situation. It should not be too much however in the Design Thinking a rapid prototyping of solutions has a real value.

9. Present your solution and get feedback

In this step an exercise participants present their prototypes to the rest of the group. During the presentation we should encourage group to ask questions and to constructive criticism. In this way the presenter has a chance to get another valuable feedback that can be used to enhance and improve the prototype again. As long as we have enough time we can ask all or selected groups to present their prototypes.

UNDERSTAND

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DT zoom IN

Lifesaving SAFARI

One of the methods to show how hard empathy is, is to encourage students to put themselves into the shoes of others. Our world is full of stereotypes, clichés that are very hard to overcome. In **Lifesaving SAFARI** it is possible to show the difficulty of acting as a different person.

That task should be done in at least two groups of about 6 to 10 person (in each group should be the same number of people). Each participant is drawing a card with a very general description of a person which must pretend during the exercise. Next, the scenario of the task is presented: “...Imagine that you went to the safari somewhere in Africa with a group of complete strangers. Unfortunately yours bus breaks down in a complete nowhere (you can’t call for help since there is no telephone signal). You need to wait for rescue team for at least several hours but maybe even days. After 3 hours of waiting, your bus is surrounded by a few very hungry lions. Having nowhere to escape, you have to decide who will first become the lions "snack", and who survives...”

Your task is to prepare a list of survivors, starting from 1 as a person who is most likely to be first lion's dinner, with the highest number of the list being the person who has the higher possibility of surviving.

The same list of participants of the trip should be provided to each team. Among the characters can be placed (Worksheet_3):

- Religion leader
- Office worker (46 years old, single father of 6 children)
- Engineer (male 32 years old, has wife)
- Scientist that is one step from the discovery of the cure for cancer (65 years old, has wife)
- Super-talented musician with alcoholic problem (male 21 years old)
- Pregnant woman (30 years old)
- Soldier (male 28 years old, single)
- Millionaire (45 years old, single)
- Nurse (27 years old, divorced)
- Child under 10 (male)
- Former prisoner (male 40 years old, was a navigator)
- Mathematician (22 years old, single, the biggest talent of the last 5 years)
- Cook (female 25 years old, fiancée)
- Black minister (34 years old, has wife and son)
- Builder (35 years old, has problems with brutality)

For the first 2 minutes everyone should think about their persona, how that particular person would behave in that situation and what he/she can offer to the group so as not to be thrown to be a lions' snack. Then each participant can use up to 3 minutes to convince others about his or her value (during that time other team members can ask questions to better know the person). After presentations the team has additional 15 minutes to discuss the “list of survivors/snacks”



and write it down on a flipchart. One person from each group presents the list and gives the short explanation of the order.

How to comment results?

The major thing is that there are no good or bad results of that exercise. Lists prepared by participants may be influenced not only by the stereotypes but also passion of the speakers or their fantasy.

Usually there are two types of “list of survivors/snacks”:

- **Oriented on the survivor** – the highest chance of surviving have people that, at the first glance have the skills which will help the group (like soldier to protect and nurse to heal the injured).
- **Oriented on the goodness** – the highest chance of surviving have people that need protection due to social reasons (like pregnant woman or child below 10).

The attention should be drawn to the fact that “profession” does not mean that someone is good at something. Many people have skills that are not connected with their work, but also hobbies or previous experience. Such additional information can be mentioned by participants during presentation of the persona. Among the stereotypes that can be observed working with **Lifesaving safari** you may come across and emphasise for example:

Religion leader	Useless since he can only pray. In fact, that person could be a missionary that is familiarised with Africa and ways of survival in harsh conditions will sacrifice.
Office worker	Useless since he is just an office worker. A solo father may have plenty of skills connected with dealing with problems, stressful situations or managing a group.
Engineer	Will build a shelter, or radio or other useful things. In fact the statement engineer does not say is in what field of studies he graduated from or how good is he in it (it might be the worst student with no knowledge)
Scientist	He has a cure for a cancer = he must survive for the common wealth. “One step from” in case of advanced researches may mean even several years. Usually such researches are conducted in teams and the knowledge is sheared.
Musician	He will be all the time drunk or aggressive because of lack of alcohol. Alcohol problems affect about 5-10% of population but it is not a popular theme. Singers are useless. Being a musician does not say anything about other skills. Musician will not help in anything. In fact being a musician requires a lot of practice that usually highly improves manual skills.
Pregnant woman	Has no skills but still is saving two lives at the same time. Usually only the aspect of saving additional life arouse without thinking about skills of the woman. She is pregnant so she needs constant care. Pregnancy in early months may even not be visible with the naked eye.
Soldier	Will protect the group. In fact we do not know what type of soldier it is, he can be a guard, commando but also radio operator, sapper, or programmer. Will sacrifice for the group and become a lion’s snack as a first since he is so brave. Of course being a soldier does not inflict neither of the above
Millionaire	He will pay us for not being killed. Money is not the only thing that he can offer he can be a acquainted with hunting or get millions of dollars from his inventions
Nurse	She will heal us. First of all there are different kinds of nurses: some help elderly and some assist during operations. What is more her nurse title could be just obtained and she has little practical experience.
Child	Too young to know anything. In fact children adopt easier to the changes of food type and in case of scout the number of valuable skills may be enormous
Former prisoner	He will kill all of us. People go to prison because of car accidents or fraud not only a murder. Navigation...what for? In fact knowledge of reading maps may become handy when someone is lost.
Cook	Everyone can cook. Yes but cooks must also manage others while working in a kitchen of any bigger local

2 Apartment Challenge

The **Apartment Challenge** is an observation exercise. Main objective is to illustrate how well people actually are to analyze and or learn what is going on by just observing. Especially in groups, the collective observation power is great.

How to do this exercise?

Take pictures of a home, and remember to remove all obvious clues.

Print the pictures and let the students try to figure out who lives in the home: name, job, age, family, interests, issues, history etc. and let them try to figure out all this as groups.

10-20 minutes is a good time for this exercise.

At the end, you should let the students tell a story and explain who lives in the home.

Alternative version of this is to actually go to someone's home and let them use 3-4 minutes to look and afterword's figure out who lives there etc.


Exemplary photos for students come from Tromsø – [Worksheet_4](#). Needed data about the person is below.

The person who lives in the Tromsø images

Marit Johansen

- *54 years*
- *Lives alone (widow) just outside of Oslo, Norway*
- *Works at Norwegian Design Council (Administrator)*
- *Has arthritis*
- *Can walk, but mostly uses a wheelchair*
- *Summer house in Spain*
- *Likes design*
- *Likes to read*

3 Village

The **Village** exercise is an excellent task for students in order to make them aware of the diversity all around the world. Some problems are known just from media and the scale of them is difficult to imagine. The exercise let observe the world as one. 

How to do this exercise?

Give students the blank cards. Firstly, they should work alone, but later they can cooperate in twos or threes. Limit the time of fulfilling the cards – give them 10 minutes. Then, step by step check each point. At the end, ask students what they have found interesting and surprising.

Task for students

Let's imagine the situation when a world shrinks and becomes a village with 100 inhabitants. Fulfil the cards with numbers (how many citizens of the new world will be in each "category") and remember that all ratios remain unchanged.

The template for the exercise is [Worksheet_5](#).

The solution for **Village** is presented below.

In the Village

- there would be: **60** Asians, **12** Europeans, **13** from the Western Hemisphere, both north and south, **15** Africans,
- **12** would speak Chinese, **5** would speak Spanish, **5** would speak English, **3** would speak Arabic, **3** would speak Hindi, **3** would speak Bengali, **3** would speak Portuguese, **2** would speak Japanese, **2** would speak Russian, **62** would speak other languages,
- **50** would be female, **50** would be male,
- **31** would be Christians, **69** would be non-Christians (**23** would be Muslims, **15** would be Hindus, **7** would be Buddhists),
- **10** would be unable to read and write,
- **11** would suffer from malnutrition, **1** would die of starvation,
- **9** would lack access to safe water,
- **33** would lack access to toilet (lack of sewage system),
- **17** would lack access to electricity,
- **46** would have access to the Internet,
- there would be **58** mobile phone users,
- **1** would live with HIV/AIDS,
- **38** would live below 2\$ per day,
- **17** would live below 1\$ per day.

Some sources of information used in **Village**:

<https://www.cia.gov/library/publications/the-world-factbook/geos/xx.html>

<http://www.worldhunger.org/2015-world-hunger-and-poverty-facts-and-statistics/>

<http://data.worldbank.org/indicator/SH.H2O.SAFE.ZS/countries?display=graph>

<http://www.internetworldstats.com/stats.htm>

<http://www.un.org/en/globalissues/briefingpapers/food/vitalstats.shtml>

<http://www.statista.com/statistics/274774/forecast-of-mobile-phone-users-worldwide/>

4

Silly Cow

Silly Cow seems to be a silly exercise, but it encourages people to think creatively and out of the box. The power is in its simplicity.

The goal of the exercise is to prepare 3 ideas – 3 business models based on COW.

Participants of the exercise need a block of Post-it® and colourful pens/markers.

The exercise can be divided into 3 steps:

- (1) Ask the group about associations with “cow” and some characteristics of a cow (makes a mooing sound, eats grass, produces milk, has markings, etc.)
- (2) Ask the group to come up with 3 ideas of “cow” business – they should draw each one on separated Post-it®. Encourage to use simple visualisations rather than words (descriptions).
- (3) Time for presentation of all business ideas. Give everybody chance to show his ideas and explanations!

5

1 object – 30 uses

1 object – 30 uses is a simple task that shows the power of group ideation. The goal of the exercise is to prepare in a team a list of at least 30 ways of possible use of a common object (bucket, brick, shoe etc.).

Usually solving that task can be divided into 3 steps. At the beginning, teams rapidly give simple examples of using the object. For example in case of bucket it will be:

- Storage of water
- Building sand towers
- Cleaning floor or car
- Homemade helmet
- Stage for one-man-show
- A canoe
- Etc.

After few seconds or minutes teams are usually drained from ideas and preparation of list drastically slows down.

In the last phase people overcome their own barriers of treating objects according to the most common expectations. To provide more ideas, they are trying to change dimensions, colour or material of the object. Among some ideas that can appear for bucket are:

- Bucket with plenty of holes can act as a watering can
- Painted in white and red strips bucket can stand instead of traffic cones
- A fountain can be created from several buckets
- From a closed bucket and some liquid a steam engine can be formed
- Etc.

It must be remembered that there are no good or bad ideas in that exercise. If any group gets stuck in phase 2, try to encourage them to think about possible ways of using a common thing in extraordinary situations like for example on a desert island or as a base for homemade present.

6

Yes, and...

Start the exercise with the negative version of it – No, but...

No, but exercise is disagreeing with member of the team and coming up with a different scenario. For example, we organize a house party .

A: Let's organize house party .

B : No , but we can go to Cinema.

A : No , but we can go to swimming pool .

B : No , but we can ride a bicycle .

This scene shows the change of subject. Team members start from the house party and end on cycling. This shows how important communication and listening is in the team to each other . The most important rule is not the denial of others' ideas, and through them to build even better scenarios.



And now, the “right” version.

Yes and method of generating ideas, by adding a new variant of an existing idea. For example the subject of brainstorming is house party.

A: Let's organize house party.

B: Yes, and ... let's prepare some snacks.

A: Yes, and ... let's prepare lots of different colored drinks

B: Yes ... and let's invite the clown

A: Yes, and ... let's shoot fireworks.

The scene shows that one theme are coming up with all sorts of extras. Topic started with house party, and ended up at the fireworks. You have to remember that during this exercise, you cannot deny the ideas of your team member. Ideas should generate to keep in mind about the theme of the exercise, in our case the "fun".

WARM-UPS

WARM-UPS

Exercises presented in this section can be used at the very beginning of the class (especially if you start early in the morning ☺) and during the work when you see that the energy level among students is getting dramatically low. Sometimes it is good to pause the DT process and make a short break to boost students' creativeness.

Keep the energy up and do warm-ups!

1 Charades

The well-known **Charades** may be used also during DT classes! The game is designed to increase creative thinking and encourage participants to involve in the work on classes. It allows better acclimatize in the group.

What do you need?	- some space in class - boxes with prepared WORDS/PHRASES (for each group)
Instruction	Participants are divided into groups of 3-4 people. The group has to select one person who will present WORD/PHRASE at one time. The idea is to use more physical rather than verbal (simple sounds) language to convey the meaning. Each participant must present 1-2 topics.
Time	Each of person from group must present 1-2 topics. Each person has to present for max 1 or 2 minutes (the time must be set at the beginning).
Comment	The point should be given when the rest of group guesses the WORD/PHRASE. The points may be written on the board. WORD/PHRASES may be from different categories, such as movies, music, academic life etc.

2 Chinese whispers

Chinese whispers – another warm-up to increase creative thinking.

Version 1.

What do you need?	- one sheet of paper (for each group) - a pen per person
Instruction	Participants are divided into groups of 4-5 people, they sit in a row. The first person from the group gets SUBJECT which must be drawn on sheet of paper. Paper with the drawing is transferred to the next person who must be looking at the picture to guess what is going on, and sketch in some drawing. None of the participants can speak. They can use only drawings to communicate. The last person must guess what is the given to the first person SUBJECT.
Time	One round for 4-5 people' group lasts around 4 minutes?
Comment	

Version 2.

What do you need?	<ul style="list-style-type: none"> - a big (A3) good quality paper sheet (for each group) - a pen per person - prepared "isolated" place for 1 person for drawing (other group's participants can't see what a person is drawing/writing)
Instruction	<p>Participants are divided into groups of 6/8 people.</p> <p>The first person from the group goes to the "isolated" place with paper and gets SUBJECT (sentence) which must be drawn on the paper. Next person looks at the drawing and quests what is the SUBJECT. He/she folds fold the paper in order to hide the drawing and writes guessed SUBJECT. The next person can see only the gusted SUBJECT, folds the paper (to hide the written SUBJECT) and has to draw the SUBJECT. Next person can see only the last drawing and creates the written version of it. The procedure is repeated till the last person.</p> <p>None of the participants can speak. They can use only drawings and guessed written SUBJECTs.</p> <p>The last person must guess what is the given to the first person SUBJECT.</p>
Time	One round for 6 people' group lasts around 5 minutes?
Comment	The paper must be well-fold after each participant.

 **Inventing scenes**

Inventing scenes is the best in the morning, when the group is sleep and not willing to work.

What do you need?	some space in class
Instruction	<p>The group of participants standing in the middle of the class. Each participant has to say an action, which the group has to do.</p> <p>Each participant presents his/her own version of the said action.</p> <p>Exemplary actions: "Riding a horse", "Dance Macarena", "Fish (with a fishing rod).</p>
Time	10 minutes
Comment	The group can stand in the circle.

4

One-two-three

Thanks to **One-two-three** your students can learn the rule – IT’S OK TO FAIL! The aim of it is to show that we can make mistakes and laugh at them (this rule is valid not only during that simple exercise).

What do you need?	some space in class
Instruction	<p>Divide your group in twos. The exercise consists of 4 stages.</p> <ol style="list-style-type: none"> 1. First stage is a trail. Students count in pairs from 1 to 3 by turns (e.g. person A – “1”, person B – “2”, person A – “3”, person B – “1”...). 2. Students count from 1 to 3 by turns, but instead of saying “1” they clap their hands (e.g. person A – <i>clap</i>, person B – “2”, person A – “3”, person B – <i>clap</i>, ...). 3. Students count from 1 to 3 by turns, but instead of saying “1” – clap the hands, instead of saying “2” – jump (e.g. person A – <i>clap</i>, person B – <i>jump</i>, person A – “3”, person B – <i>clap</i>, person A – <i>jump</i>, person B – “3”, ...). 4. Students don’t count – they clap for “1”, jump for “2” and turn around instead of saying “3”.
Time	First stage should last around 30 seconds. Other stages takes approximately 1 minute each.
Comment	<p>Before your students start doing each stage of the exercise, show them how it should work.</p> <p>You can use the proposed combination – clap, jump and turn around, but you can invent your own version.</p> <p>It is worth encouraging students to do each stage faster (when they feel comfortable with the task).</p>

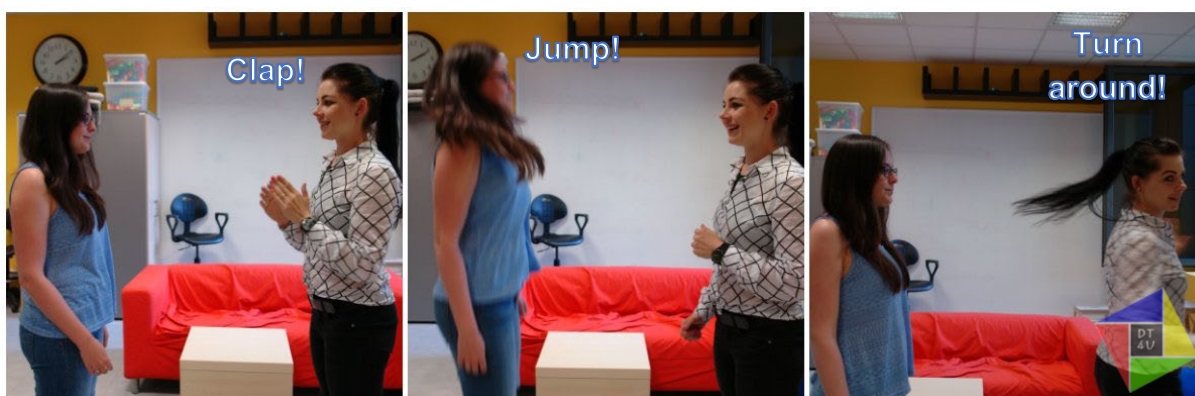


Fig. 1. Three actions in a row instead of counting 1-2-3.

5

Hands

Hands is the perfect exercise in the morning at the beginning of DT classes. You can start with it to give latecomers some time and help students to “wake up” their brains.

WARM-UPS

What do you need?	big table to sit around
Instruction	<p>Everyone puts his hands on the table. Set the direction of the movement (clockwise or counter-clockwise). The task is to hit the table hand by hand in set direction (as in figure 2). By hitting twice in the table you change the direction (to the opposite one) of hitting (as in figure 3, hand with number 4 and 5 changes a direction). A hand is dropped out when it doesn't hit the table in proper moment or hits it unnecessary (out of turn). The task is finished when 2 pairs of hands are left at the table.</p> <p>The exercise can be harder when the setup of the hands is different (a hand of participant “1” is surrounded by 2 hands of his neighbours, as in the picture below)</p>
Time	You can do the exercise even 20 minutes (it depends how many students take part in, how much they are involve, how much they like the exercise)
Comment	It is a good idea to join to students in the exercise (a tutor is a activity participant).

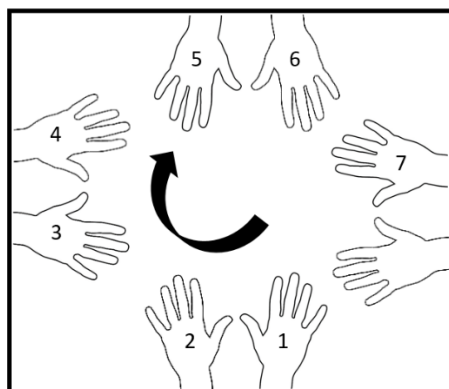


Fig. 2. Single hitting the table (hand by hand)

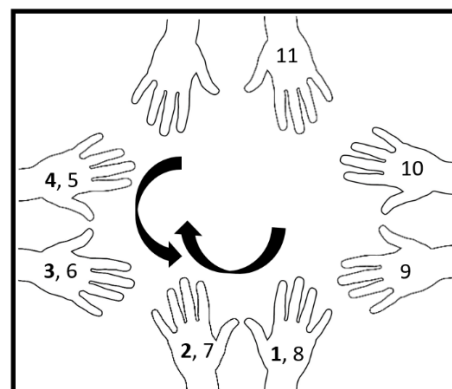


Fig. 3. Changing the direction by double hitting (hand with numbers “4, 5” changes direction from clockwise to counterclockwise)



Fig. 4. Warm-up during Hand exercise (DT4U, Lodz).

6 Cards

What do you need?	A deck of cards
Instruction	Give everyone a card and tell them not to look at it. All participants must hold or mount the card to their forehead with the number and suite facing outwards. Have everyone walk around saying only "hello" to each other With their body language, they will let the others know if they are "high ranking" or "lower class". A king is the highest "ranked" person in the group and a "2" is the lowest. After 4-6 minutes have everyone stand up on a line and place themselves in a line, where the lowest people are at one end and gradually you should have the king at the other end. All this should be done without anyone knowing what card they themselves have.
Time	10 minutes
Comment	Join the exercise to get a feel of time. When you have greeted the same people multiple times, it is time to end the greeting phase and stand up in a line.

7 Rock-Paper-Scissors

What do you need?	A room or place you can make a lot on noise.
Instruction	Have everyone find a partner, with that partner you should do rock paper scissors. Best of three. The winner must as soon as possible find another winner and challenge him or her. The fun part of this exercise is that the loser must become the biggest supporter of the winner. This means screaming and shouting on the top of his lungs etc. this

	lasts until there is only 2 winners left, and 2 large groups of supporters. Have a final battle where everyone is shouting like crazy.
Time	5 minutes
Comment	Join in the exercise. Go a bit crazy so that the students realize it's good to go a bit crazy on the supporting.

Although the name "prototyping challenges" suggests that activities described in that parts are mostly devoted to the final stages of DT process, there is much more occasions to incorporate them into the process of creative development. Among the key functions of such actions are:

- Building an integrity of a team
- Recognition of the team role
- Boosting creativity
- Showing numerous solutions to the single task
- Introduction of the theme "it's OK to FAIL"
- Focusing attention on the multiple repeats of testing before providing final outcome
- Base for discussions concerning for example: introduction of the product to the market, industrial espionage etc.

In the following part, you will be provided with several propositions of the tasks with their short description. The key aspect of prototyping challenges is to divide participants of DT course into groups which will compete in fulfilling of the provided task. Each task is based on manually building a structure with the provided materials on the basis of the own idea of each group. The word CHALLENGE is committing on many levels. First of all, the goal of that type of exercise must be stated clearly. Secondly, the last but not least, the reward for the winners cannot be forgotten. Of course it is mostly symbolic (chocolate bar, snack, bravo of the whole group etc.), but still it shows all the students that theirs efforts should be appreciated. Another aspect is that even teams that will obtain worse results, or even do not fulfil the task should be positively encouraged to further work.

We encourage to adjust each task according to the capabilities and needs of each group and place of conducting tasks for example all those tasks can be performed outdoor yet they may become more challenging due to the unexpected weather conditions for example blows of wind.

1

BASKET TENNIS CHALLENGE



The idea of Bucket Tennis is to build the construction that will enable transportation of tennis ball from a point on a desk or table to the bucket placed on a floor. The victory is achieved by setting an additional goal like obtaining the highest number of repeats in a minute or minimal time of 20 repeats. That activity should be performed for at least 2 groups of 3 to 5 people. The time for constructing should be about 20 minutes, but the additional time for succeeding a challenge have to be taken into consideration. There are no strict regulations concerning materials necessary to fulfil that task but the ones that should be considered are:

- scotch tape (lack of that material or its equivalents makes the challenge much more demanding)
- pieces of cardboard
- wooden or plastic sticks
- foil
- carton boxes
- insulation pipes
- straws
- rubber bands
- etc.

There are two ways of distributing the materials. First is similar as in Marshmallow Challenge – each team gets the same kit of materials. In the second option you prepare the depot with all the materials in the selected area. Only one person established by the team can enter the depot and take necessary good. Teams cannot store materials on their own – tutor should bring it back to the teams with too much spare goods. Such option promotes more diverse constructions, but tutor must be prepared to mitigate conflicts that may appear between teams.

RULES

1. The winning team is the one that place tennis ball in the bucket the highest number of Times in 1 minute interval
2. Ball cannot be touched by any team member from the start till placed in the bucket
3. The most demanding is to begin the movement of the ball. Addition of constrain ensures building of some construction and not playing basketball.
4. Ball have to be in move from the starting point till placed in the bucket
Move does not mean just rolling, allowed is also placing a ball on any other moving object.
5. Starting point is marked with X and it cannot by overbuild.
6. Ball have to get back to the point marked with X before next trial of placing it into the bucket.
Only during that stage of Bucket Tennis the ball can be taken into hands
7. Bucket cannot leave the area marked with tape.
The best distance between the X and the bucket is about 1m
8. The table (with X mark) cannot be moved (all 4 legs must be placed on the floor)
9. There is only 20 minutes for prototyping.
10. Rules will not be furtherly explained after the start of the exercise.

PICTURES

Fig. 5. Students from TUL during Basket Tennis Challenge.

Cons

The disadvantage of Bucket Tennis is the amount of materials that must be prepared for that task. To little diversity makes the solutions very similar (mostly any type of ramp) and as a result similar time of 20 repeats.

There exist more threats of building very similar constructions by the teams provided with the same materials.

Pros

Usually involves bigger constructions which appear more appealing to the most of the groups.

The evaluation part is conducted separately for each team (the order can be random) so even the solo tutor can handle it properly.

Comments of the results and team behaviour can be the same as in case of Marshmallow challenge.

How to comment results?

That type of prototyping challenge requires not only building a construction but also using it. Some teams are focusing less on building but more on team work during challenge itself. Diversification of the roles may appear for example one person is taking ball from the bucket second is passing it and third starting its movement. In that way several second can be spear with each repetition. Another thing is ball escaping from the bucket – since it cannot be touched with hand unprepared for that occasion teams may end up a challenge with poor result.

2

CANDLE TRANSPORT CHALLENGE

The candle transport challenge is a team based competition/exercise that's made to illustrate the importance of prototyping and testing. The exercise is time consuming and resource demanding, but never fails to give the participants a fun and memorable demonstration of the importance of prototyping.

We (the DT lab and partners) have standardized the Candle transport Challenge for several reasons. One of them is the measuring and testing we can do related to the challenge. There is no need to do the challenge in the same way as we do.

Below is a detailed description of how to run the challenge and what you need to do so.

The setup

You need to build one or more water canals. We usually have one canal per 4-5 groups. For bigger crowds more is needed.

- The canal should be 3m long and about 25cm – 30cm wide, water depth should be about one finger deep.
- Set up a normal table fan at the end of the canal.
- Create a scoreboard. On this board you as the admin will note down the time of boats and number of attempts.



Each group needs a kit of equipment, the kits should contain:

- 1 A4 paper
- 1 20x20cm cardboard
- 1 roll of tape
- 1 scissor
- 1 knife
- 1 glue-gun
- 1 lighter
- 2 small spunshes
- 1 roll of aluminum foil
- 2 thin wooden rods
- 2 straws
- 2 tea candles

During the challenge

Give out one kit to each group and give them 25 min to build solutions.

The instructions is; they will have 25 min, so create something that can transport one burning candle from one end of the canal to the other. They can try as many times as they want, and the fastest solution wins.

It is not allowed to touch the solutions after they place them in the water, and the candle must burn when the solutions reached the far side of the canal.

You will write an X for every failed attempt a group makes, and the time of every successful attempt. At the end of the challenge there is usually a clear correlation between number of attempts and time. Ai. More attempts/fails = better time.



Fig. 6. Candle Transport Challenge at University in Tromso (DTLab).

BALLOONING EGG CHALLENGE

The **Ballooning Egg Challenge** is a team competition that allows illustrating the process of ideation, prototyping and testing. The exercise needs no more than one hour (including prototyping and testing) and requires some resources for prototyping. Nevertheless, it does not need special installations for testing, just an elevated (around 3 or 4 meters) balcony outdoors or a window. The participants get guaranteed fun and... perhaps some unclean clothes!

The idea is to create a device (a kind of flying vehicle) to land an egg safely, descending it from the balcony to the ground, avoiding the egg crash.

SETUP

You need to identify an elevated platform of around 3 or 4 meters over the floor level, preferably outdoors: indoors would be more comfortable, but perhaps a bit unfriendly for cleaning staff. You also need a chronograph to measure the descending time and a blackboard to register the records and to indicate the failed attempts.

Each team has to choose 4 items of the following list of materials:

- a pair of plastic balloons (like used in children birthday parties)
- two plastic cups
- rubber bands
- one clay block
- five chopsticks
- five popsicle sticks
- five assorted rubber bands
- 8 small binder clips
- string (about 100 cm)

Besides, a number of chicken eggs are compulsory to provide crew for each vehicle. You can limit this number to two or three by team, or to deliver unlimited eggs. It depends on the time you decide to use.

Alternatively, only one egg could be done to each team, in order to clearly limiting the time to expend in this exercise.

RULES

1. Each team will construct a “vehicle” that helps a regular chicken egg to descend from balcony to ground level maintaining its integrity.
2. At least 50% of the egg’s surface has to be visible.
 - This means that a team cannot cover completely the egg to absorb the floor impact.
 - Playing with this “open surface”, allow adjusting the difficulty of the challenge.
3. The testing consists of leaving the pack egg + vehicle freely descend from the balcony, while measuring the descending time.
4. The winner team would be that which egg lands on safely (no smashed) using as much time as possible.

In case of no surviving egg, additional time can be provided in order the teams can improve their vehicles.



During the challenge

The tutors have to motivate the teams to save the descending eggs, creating a funny atmosphere.

After each attempt, the descending time has to be registered at the blackboard in case of successful land on.

Depending on the organization, the game finish when one team succeeds in landing on the egg as one piece, or each successful team is permitted to try again with a different design.

The winner is the team which egg lands on safely and takes more time during the descent, as this means that the egg descends slowly and softly.



Fig. 7. Ballooning Egg Challenge at University of Vigo.

There exists the conviction that the world can be divided into creative and non-creative type of people. Design Thinking methodology is totally against that! Everyone is creative but not everyone is creative-confident. CREATIVE BOX consists of set of tasks for students to open their minds, think outside the box and develop their creative born skills. Just BE CREATIVE!

1 LINE GAME

The line game is done to illustrate for the students that they are creative. The exercise shows that the students are creative, and their biggest limitation to creativity is their own mental blocks and barriers, rules they have come up with themselves.

The template for the exercise is [Worksheet_6](#).

Part 1.

Draw 4 straight lines that go through all 9 dots, without lifting your pencil. This is quite difficult and not many students will manage this.

Part 2.

Draw 3 straight lines that go through all 9 dots, without lifting your pencil. This one is quite simple actually. The trick is that the student will have to draw the lines over the logo on the bottom of the page or over the text on the top of the page. They will also have to draw the line through the edge of the dots, not through the center of the dots.

Part 3.

Draw 1 straight line that go through all 9 dots, without lifting your pencil. This one is simple, now the students should realize that they are allowed to break the “rules”. Try to have the students come up with many solutions. There are many.

2 30 CIRCLES

The creativity exercises are crucial elements in ideation processes, when the idea flow is „stuck” and brains are no longer functioning the way we want them to do. To boost the creativity, creative icebreakers are stimulating and enhancing the ideas development.

30 circles exercise was developed by Bob McKim from Stanford University in 1960s'. Its role is to “wake up” the creativity before or in the middle of ideation session.

The template for the exercise is [Worksheet_7](#).

The idea is to fill in as many circles as possible, within the time period provided – usually it is 60 or 120 seconds (depends on the group’s abilities). Students can fill the circles with objects of some form or with a pen or marker – the way they do it is up to them!

The main clue of the exercise it to adapt as many of these circles as you can into objects of some form. The only thing that matters is quantity – not quality.



Things to remember when evaluating the exercise:

- It is not forbidden to fill all the circles in the same way or by the same objects – the quantity matters.
- Ask how many circles people have filled in – 5, 10, 15, 20, 30? (Most people don't finish the exercise and that's alright).
- Check how many circles were filled (if not all of them – why a person was stuck during the exercise?) and how diverse the answers were?
- Are the ideas derivative (e.g. volleyball, baseball, basketball, tennis ball) or distinct (e.g. sun, ball, cookie)
- Did anyone fill not only circles but use the spaces outside the circles, or maybe combines 2 or more circles to form a bigger picture?

Team is one of the most important element in doing projects! Everything is about people. People can find the real problems and solve them. In DT projects students need to be integrated, they should know their strengths and weaknesses in order to use their potential as individuals and as a group. During classes/ workshops some team building exercises are strongly recommended.

1 ABCDE

Team members sit as shown in figure 8. Each team member gets a card with symbols and sticky notes. Team members cannot talk to each other, communication is done only through notes. Person A is the team leader, she/he has got the symbols in his paper. A person may only contact with the person B. Person B can communicate with everyone. People C, D, E may only contact with the person B. The team must exchange information to determine which common symbol all team members have. In this exercise, a major role is played by person B, she/he filters the information from persons C, D, E and forward them to the leader A. This exercise is designed to help understand the importance of team communication and how important it is to analyze (filtering) all important messages from team members.

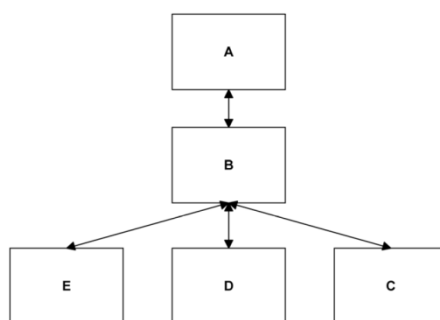


Fig. 8. Scheme of communication in team members.

<p>What do you need?</p>	<ul style="list-style-type: none"> - chairs set as shown in Fig. 8 - sticky notes, - sheet of paper with task, - pen
<p>Instruction</p>	<p>Team members cannot talk to each other, communication is done only through notes. Person A is the team leader, she/he has got the symbols in his paper. A person may only contact with the person B. Person B can communicate with everyone. People C, D, E may only contact with the person B. The team must exchange information to determine which common symbol all team members have. In this exercise, a major role is played by person B, she/he filters the information from persons C, D, E and forward them to the leader A.</p>
<p>Time</p>	<p>5 minutes</p>
<p>Comment</p>	<p>This exercise is designed to help understand the importance of team communication and how important it is to analyze (filtering) all important messages from team members.</p>

2 TIED UP

The aim of **Tied up** is to improve communication skills in the group and show how important is cooperation between team members in order to achieve common goal.

What do you need?	- rope or something to tie together the hands of participants - additional materials for tasks: bottle of water, plastic cups, paper boxes, colourful wrap papers, scissors, tape, etc.
Instruction	Organize groups into an inward facing circles. Tie the participants together by their wrists (as in the picture). <u>Warm-up:</u> pour the water in plastic cups for all team members. <u>Task 1:</u> Christmas time is coming and you have to wrap the presents in colourful wrap papers. <u>Task 2:</u> draw the portrait of your team member. <u>Task 3:</u> jigsaw puzzle
Time	Each task should be time-limited. 1 minute for warm-up, 2 minutes for task 1 and 2. Time for task 3 depends on used puzzles.
Comment	Limiting the time of the tasks makes the exercise more difficult.



Fig. 9. Wrapping presents during Tied up exercise.

3

BLIND DRAWING

Blind Drawing builds communication in teamwork and problem solving by having groups cooperate in drawing a pre-drawn object or word.

What do you need?	<ul style="list-style-type: none"> - a square table, six chairs; - a permanent marker or a pen; - a rope or another type of flexible handle; - A4 sheet of paper; - 4 pieces of black cloth belts;
Instruction	<p>Divide your workshop group into subgroups of six. Assign four members of the group to be Drawers, one to be a Talker and one to be a Viewer.</p> <p>The Drawers draw what they hear from the Talker being blind. They may not talk and they have to use pieces of black cloth belts to cover their eyes. The Talker steers the group by using information that the Viewer is saying to the him and using Drawers names (Silvia straight line to your left, Tom 5cm straight line towards you, Mathew loosen the rope, etc.). The Viewer is the only one who sees the pre-drawn shape or word, and he tries to describe the drawing to the Talker using only non-verbal communication.</p>
Time	<p>Give 15 minutes to complete the drawings. Then some time (depends on the amount of groups) is needed to compare the drawings and talk about the teamwork in the groups.</p>
Comment	<p>A permanent marker has to be reliably fixed to four equal in length ropes or another type of flexible handle.</p> <p>The A4 sheet of white paper should be positioned in the table center. The Drawers have to sit at edges of the table and must take ropes in their hands.</p>