The Potential of Human-Centred Design (Thinking) for Education

LILIANA RUCTTINGER | NSW DEPARTMENT OF EDUCATION

AARE 2015 | Fremantle, WA

Human-Centred Design is based on the philosophy that developing useful products, services, environments, organizations, and modes of interaction begins by learning from the people for which the solution is being designed. The implementation of Human-Centred Design is based on the adoption of a number of mindsets, focused on the practice of resilience, creative confidence, empathy, the acceptance of ambiguity, optimism and a willingness to iterate.

Human-Centred Design requires critical and creative thinking. It is also underpinned by empathy. The work of practitioners is based on the contexts, emotions and needs of their stakeholders through the building of a respectful understanding of their position. This connection to the ACARA General Capabilities suggests that the thinking "tools" offered by this design paradigm may be of particular value to the development of educational activities for students. As a design practice, Human-Centred Design offers a particular perspective to the design of educational "products" such as curricula and assessments. Adopting the viewpoint of the beneficiaries of these products is potentially disruptive to established notions of expertise.

In relation to the design of systems that are human-centred by definition, this design philosophy may provide insights to address persistent systemic challenges. Such challenges include the development of teacher support systems and professional networks, as well as the communication of organizational policies and practices.

The characteristics of Human-Centred Design present a potential divergence from certain types of research practice. Following the cycles of inspiration, ideation and implementation, the role and authority of the research practitioner is blurred with that of the stakeholder. Experience suggests that practitioners in a range of domains are likely to be open to research findings to inform their practice only if researchers understand their specific context and working conditions. The ability for Human-Centred Design to address this issue may provide a potential bridge between research and practice.

This paper discusses the potential that Human-Centred Design has for educational practice, research and communication systems that foster communities of practice.

Disclaimer: The views expressed in this paper are the author's own and are not representative of those of her employer, the NSW Department of Education

au.linkedin.com/in/lilianaructtinger

liliana.ructtinger@det.nsw.edu.au

paper https://goo.gl/m95X05

prezi http://goo.gl/ifuiRL

Contents

Introduction to Human-Centred Design 3
What is Human-Centred Design? 3
The people in Human-Centred Design 4
Mindsets 6
Empathy 6
Optimism 6
Iteration 6
Creative confidence 6
Making 6
Embracing ambiguity 6
Learning from failure 7
Phases 8
Inspiration 8
Ideation 8
Implementation 8
Methods 9
How might HCD be used in the field of education? 19
HCD for Government and policymakers 20
Inspiration 22
1. Organisation and planning 22
2. Data collection 22
Ideation 22
3. Data sharing and synthesis 22
4. Generating ideas 22
5. Creation 22
Implementation 22
6. Testing 22
7. Revising and revisiting 22
8. Launching 22
Revised business process 23
HCD in the classroom 23
Designing digital learning tools 23
Informing the design of learning spaces 24

Encouraging students to adopt positive mindsets 24
HCD for teacher professional development 25
Designing a knowledge management platform 25
HCD for research 25
Developing communication plans for projects that involve multidisciplinary teams 25
How is Human-Centred Design different to what we do already? 27
Conclusion 29
Appendix A. Related concepts 30
Frameworks 30
Tensions 30
Design Contribution Square 31
Appendix B. Other problem-solving approaches 33
Citizen-centric approach 33
Science-based design 34
Environmentally sustainable design 34
Technology-driven design 34
References 37

Introduction to Human-Centred Design

The human world is complex and interesting. It presents countless combinations of novel problems which are open to interpretation and potential solutions. The domain of education is no exception to these complexities. Human-Centred Design offers an approach to solving problems in ways that designers do and in ways that keep humans at the heart of the solution.

This paper outlines what Human-Centred Design is, how it can be implemented and the sorts of problems it could help to solve in policymaking, classrooms, teacher professional development and education research.

What is Human-Centred Design?

Human-Centred Design is a problem-solving approach that is focused on learning from the customer of the intended solution, particularly through empathic methods – its defining feature (Sklar & Madsen, 2010). As an "outside-in" approach, Human-Centred Design is based on the philosophy that developing useful products, services, environments, organizations, and modes of interaction requires learning from and understanding the people for whom the solution is being designed.

The growing adoption of this approach mirrors the transition of economies in the developed world, shifting from industrial manufacturing to knowledge work. Design is more frequently accepted as a way to solve problems beyond the design of aesthetic physical products – it is increasingly being applied to the development of new processes, services, computer-mediated interactions, entertainment and ways of communicating and collaborating (Brown, 2008). The methods of Human-Centred Design may also have potential applications beyond customer service to the areas of educational practice, research, and communication systems that foster communities of practice.

Human-Centred Design is part of the family of Design thinking; in practice these terms are used synonymously (Brown, 2008). The relation between the two could be considered the distinction between design thinking as a property of the "thinker" and Human-Centred Design as a set of principles and processes to solve a particular problem in ways that preference the "user's" needs (Roschuni, Goodman, & Agogino, 2013). Furthermore, some design research literature present user interactions primarily as learning opportunities to advance the design, not in empathic terms (Stoker & John, 2009). For of these reasons, the term Human-Centred Design better aligns with the practical orientation of this paper and on the importance of the empathic mindset.

Designers have historically borrowed various methods from more established human research disciplines, such as marketing, psychology and anthropology, to collect information about users in a valid and reliable manner. These conventional methods based on 'scientism' were found incapable of embracing people's felt-experiences and design imagination – this inadequacy is attributed to the researcher being objective and distant from the subject. Empathic design attempts to make sense of how human

beings experience the world, through their bodies and minds and situates that experience in their own socio-cultural context (Lee, 2011).

Empathic methods incorporate shared language (using spoken, written text, body language or visuals), collaboration (including users in the research rather than doing it to them), ethnography (observing and recording interactions and artefacts of users in situ) and empathic modelling (experiencing with your own body the physical situations of others), practitioners are able to apply and integrate the insights and awareness of users with functional design rather than simply responding to a user's perceived needs (Thomas & McDonagh, 2013).

Human-Centred Design consists of three considerations: mindsets, necessary for being able to engage with the work; phases, providing conceptual guidance to frame the process; and methods. An important part of understanding Human-Centred Design is distinguishing between roles, and the ways in which they are referred to in the literature.

The people in Human-Centred Design

Human-Centred Design terminology varies depending on the field of expertise of the writers. For example, writers with a design background tend to focus on the "users" and "designers", whereas writers with backgrounds in the human services tend to use the language of "stakeholders" and "practitioners". The intentional blurring between these roles promoted by Human-Centred Design is captured in the varied use of this language which is used in the literature as presented in Figure 1.

"Users" and "customers" are interchangeable terms, depending on the context, referring to individuals that will have direct experience with the solution that is being designed. They may also be beneficiaries; those that stand to gain from the solution. Beneficiaries are a type of stakeholder; those that have an interest in the solution being developed in ways that may benefit or harm them. In an education context stakeholders may include policymakers, teachers, students and researchers. Practitioners generally lead Human-Centred Design projects.

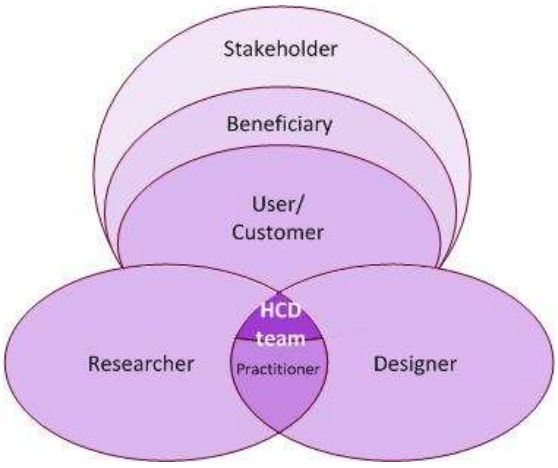

Figure 1. Individuals involved in Human-Centred Design

The core members of the Human-Centred Design team are practitioners (composed of researchers and designers) and users or customers (who may also be beneficiaries or

stakeholders of the outcome of the work). The Human-Centred Design team come together at different points throughout the project, depending on changing needs. While an individual may move in and out of the Human-Centred Design at different times, a defining part of their participation is the mindsets that they adopt throughout. This is particularly important to remember in the context of schools, where students may take on these roles as part of projects they are working on.

Mindsets

A particular pattern of mindsets, or perhaps more accurately, the acceptance of particular practices, are considered to set Human-Centred Designers apart from other problem solvers. These need to be adopted to successfully engage with the Human-Centred Design process (IDEO.org, 2015). These mindsets reflect openness to ideas and solutions unrestricted by current operational limitations or dogma.

Empathy

At the cornerstone of Human-Centred Design, empathy is a key mindset that is required to understand different people, scenarios and places. It provides a way to include the people you're designing for into the design process, to leave behind preconceived ideas and old thinking and to keep work grounded in the reality of users.

Optimism

Practitioners must hold the belief that design is inherently optimistic, that an answer is not yet known but that a way is out there to be found. Optimism is necessary for perseverance throughout the iteration process.

Iteration

Iteration is integral to Human-Centred Design. It requires feedback, which presents an opportunity to further the participation of those being designed for. Essential to iteration is the need to venture outside of the design team to test and reflect. Being open to iteration is important because there will be a need to revisit initial ideas and strive to constantly improve on them.

Creative confidence

This mindset relates to the confidence in the ability to act on ones ideas combined with the belief that everyone is creative in the way that they understand the world. Creative confidence involves trusting intuition and going forth with ideas that you haven't quite mapped out in detail yet.

Making

The ability to make is about being able to first convey an idea and then to turn it into a solution. This mindset builds on the notion that theory (the idea behind a solution) and making (a solution without a theoretical grounding reasons) in isolation less powerful as the two combined. The making mindset is required to prototype, which needs to be done throughout the process.

Embracing ambiguity

This mindset requires an acceptance that not all the factors involved in a problem can be known at once, if at all. It involves being open to the idea that there will always be more ideas; there is no need to hang on to any one of them. It is this inability to know all of the answers that allows innovation to happen, since it means that the boundaries of the problem space are not clear and open to possibility.

Learning from failure

It's rare to achieve the right solution the first time, so the ability to learn from failure is essential to Human-Centred Design. Refusing to take risks limits designers to only incremental solutions rather than opportunities to innovate through radical departures from the norm and known.

Mindsets are important throughout all phases of Human-Centred Design, although some of them will become more relevant at particular phases than at others.

Phases

The process of Human-Centred Design falls under the three broad phases of inspiration, ideation and implementation (IDEO.org, 2015). These phases are overlapping, complementary and non-linear. There are aspects of the process that are already commonplace in the practices of any established organisation.

Inspiration

This is the research phase in which practitioners use different means to learn about their customers. Organisation and planning is a key part of this phase, which begins by defining the design challenge – what to set out to achieve. It also involves identifying the individuals and groups that will be a part of the research – this includes the beneficiaries and stakeholders as well as the people who will be a part of the design team. Inspiration activities provide the framework for data collection, consisting of insights and evidence from primary and secondary sources, particularly the people who will be impacted by the solution.

Ideation

During the ideation phase team members share and analyse the insights that they have gathered from their work during the inspiration phase. The team participates in collective brainstorming and synthesis activities which lead towards the development of ideas that can be created into prototypes, ready for testing.

Implementation

Team members are involved in gathering feedback about prototypes through rapid testing and extended piloting activities. Importantly, this phase of the process requires an openness to revising and revisiting assumptions as well as the solution itself. Launching the solution incorporates a plan for ongoing evaluation and monitoring.

Keep in mind that these phases are not linear and that Human-Centred Design methods are applied throughout the project. The following section details these methods, when they can be used, why and where to find further information.

Methods

A selection of Human-Centred Design methods are detailed in Table 1 as they pertain to the purpose of this paper. This table uses the phases of inspiration, ideation and implementation (Brown, 2008; Brown & Wyatt, 2010; IDEO.org, 2015). Methods are also labelled according to more familiar project language, as shown in the Collection column. Italicised text refers to another method in the table or in the Further information column of the same row. Underlined text refers to a Collection name. Further information provides references including exemplars, template documents and hyperlinks to NSW Department of Education internal documents. A process for applying these methods is presented in the next section.

Method	Why to use it	How to do it	When to use it	Collection	Further information
Frame your design challenge	This is the first step to commencing a Human-Centred Design project in which the team agrees about the problem they are solving.	A 1-page summary of the problem that the team is attempting to solve. Start with an overarching contextual statement and then answer the following 5 questions in no more than one sentence each to narrow down the design question that you will answer as a team: 1) Frame the problem as a design question 2) State the ultimate impact you're trying to have 3) What are some possible solutions to your problem? 4) Write down some of the context and constraints that you're facing 5) Revise your original question	Inspiration	Organisation and planning	(IDEO.org, 2015, p.31; example, p.33; template, p.165) An alternative approach by Brest, Roumani and Bade (2015) is not recommended since the problem is defined by the decision-maker
Create a project plan	To consider project logistics and follow any organisational requirements to commence the work.	Refer to established internal organisational procedures.	Inspiration	Organisation and planning	Seek advice from a business development unit on project planning.
Secondary research	An essential stage of understanding existing information about the context, history and data related to your problem. This knowledge provides a foundation to build upon with primary data collection.	*Conducting a Literature Review*. Investigate whether other organisation are already addressing the problem.	Inspiration	Data collection	Consult *PP&R Literature Review Process* and *Literature Review Rationale*. See also, *Learning whether other organisations are addressing*

					the problem effectively (Brest et al., 2015, Step 8, p.14)
Identifying the right people (project team, participants and customers)	This is an important set of resources to use when identifying the right people for different aspects of the project. It is necessary for building a team, recruiting participants, defining the customers who will use your solution.	After you *Create a project plan,* identify essential areas of need and then consider how to *Build a team* with an interdisciplinary mix. Limiting your team to the traditional project specialisations will likely result in a traditional solution. You may develop insights about who these non-traditional project members may be after Data sharing and synthesis activities. Once you reach implementation, you may need to rethink who you need to *Staff Your Project*. Start to *Define Your Audience* – these are the people you are designing for (customers). This involves identifying your direct beneficiaries and then peripherally relevant groups and individuals – both those that may be in favour or opposed to your work. Use post-its to write each person or group. Consider how they relate to your work and the solution and write those on separate post-its, then arrange them to reflect the relationships that need to be considered throughout the project. Use *Recruiting Tools* to develop a strategy to find the right people to learn from. Your participants are not necessarily the same people that will use the solution. Be mindful of incorporating both *Extremes and Mainstreams*.	Inspiration Implementation	Organisation and planning	(IDEO.org, 2015; build a team, p.35; recruiting tools, p.36; define your audience, p.44; extremes and mainstreams, p.49; staff your project, p.144)
Interviews	Interviews are one of the primary ways in which you will be collecting information about the needs of your customers. They should form at least some part of every Human-Centred Design project. The Human-Centred Design process can benefit from the combination of individual, group and expert interviews. Group interviews can serve as starting points for identifying key individuals who may be suitable	Plan to conduct interviews in the participant's space or the problem setting if it is one and the same. The responses of the participants will likely be more meaningful when understood in their natural context. Consider whether it would be beneficial to conduct a one-on-one *Interview,* a *Group Interview* or an *Expert Interview*. Up to three research team members may attend an interview and each with a clear role, such as interviewer, note-taker or photographer. Use an interview protocol and consider using *Conversation Starters*. Start broad and shallow, asking questions about the person's life, values, and	Inspiration	Data collection	(IDEO.org, 2015, p.39; example, p.41; group interview, p.42; expert interview, p.43; conversation starters, p.45; template: p.166)

	for the individual and expert phases of the research.	habits as they relate to the problem context. Then go deeper on questions that relate specifically to the design challenge. Your participant's responses should be recorded verbatim – interpretation happens later. During the interview, notice body language, the surroundings and anything can learn from the context – you may decide to take photos.			
Immersion	This technique is useful in understanding a cultural change that you are attempting to facilitate. It is likely to be relevant in cases where it is difficult for participants to articulate their ingrained day-to-day experience.	Observation of the setting in which the people that you are designing for spend their day. This may be the same location as the solution. You may decide to shadow the participant, to be an inconspicuous observer from afar or to have them walk and talk through what they are doing and why – a *Guided Tour*. The approach will depend on the relationship that you are establishing with the participant, if any exists at this stage. Documentation is essential.	Inspiration	Data collection	(IDEO.org, 2015, p.52; guided tour, p.64)
Analogous inspiration	This is an explorative technique that allows consideration of possibilities that are not available in the setting that you are designing for but are plausible and accepted in other settings. It can work well with *Mash-ups*.	Start by listing the activities, behaviours and emotions that you're looking to research. Then write down a setting or situation where you might observe each one. Decide on the setting or situation and conduct an observation, paying attention to the particular activity, behaviour or emotion that connects it to your research goal.	Inspiration	Data collection	(IDEO.org, 2015, p.53)
Card Sort	Understand your participant's values in the context of data collected from earlier inspiration activities and preliminary data sharing and synthesis activities.	Prepare a deck of cards with one word or image on each. The contents of the cards will likely come from earlier inspiration activities, such as those collected from interviews. Participants are asked to order them according to what is most important, or to sort them according to a hypothetical scenario, such as working different hours, having a different work role, or different responsibilities.	Inspiration	Data collection	(IDEO.org, 2015, p.57)
Peers Observing Peers	See the design setting through the eyes of those you are designing for. This is particularly useful when the setting is logistically difficult to observe. It is also useful to overcome perceptions of invasion or fear of outsiders that may be encountered by participants by building relationships with them. This is distinct from *Immersion*, since it relies on participants acting as researchers,	Equip the people that you are designing for with materials to record their experiences. This can include traditional pen and paper, cameras and audio equipment.	Inspiration	Data collection	(IDEO.org, 2015, p.60)

	rather than the project team doing the observation.				
Game play	The use of visual methods allows stakeholders to imagine other scenarios and realities, developing empathy for those in other situations but also permitting the suspension of accepted norms for the duration of the game. This allows the exploration of alternative futures – a useful tool to use when radical innovation is intended.	The contents of the cards are developed in the inspiration phase. The game play occurs primarily during ideation. Create a series of visual cue cards, or reuse cards from the *Card Sort*. These should contain objects and ideas relating to the problem you are trying to solve, or relate to issues you have seen through your research. They act as a starting point for a discussion. Create persona cards which reflect the customers of your project. The scenario cards will include the settings that your customers work in and relate to your problem. Have each participant play a persona that is different to their own real-life role, choose a setting for the entire group and assign each person a visual cue card. Observe and record. This is also a good opportunity to have your own project team participate to help them empathise with the customers.	Inspiration Ideation	Data collection Generating ideas	(Sherringham & Serle, 2011)
Double ethnography	This approach is useful in cases where practitioners are working outside of their team to solve a problem. The aim of this approach is to identify resistance to change by understanding organisational culture. Future design efforts then target these "sites of inertia" in order to produce research insights that can be acted upon and are likely to be socialised (or shared among the HCD team which includes users and customers). This is a form of self-reinforcement which is likely to mean that the solution is likely to work well since ownership will be ingrained in the process of conducting the research. This is particularly useful to help researchers figure out how to communicate across boundaries of expertise, culture, and interests. It is termed double ethnography because it requires researcher to	Informed by initial findings of themes from Data collection activities, the research team considers future interactions with the client that may further inform these themes. This may occur during project meetings, when accompanying clients into the field. Use these findings to identify "sites of inertia", which are places that it is possible to achieve cultural change. When communicating with your clients Use photographs and non-textual information to communicate findings. This also provides a way to demonstrate an understanding of their context as well as to build empathy between the clients, customers and researchers.	Inspiration Ideation	Data collection	(Roschuni et al., 2013, p.51)

	treat communication activities that are part of their HCD project as a project in itself.				
Download and share	It is necessary to share the data you have collected with the rest of the team so that you can make sense of the context you're working in.	Bring the practitioners together; it is important that this step is conducted as a team. Ask that everyone come to the meeting with all data collected and examples of any photographs or artefacts that they want to share. Everyone is given post-its and writing material. Record all key information you want to share according to: who you met, what you saw, the facts you gathered, and your impressions of the experience. Each person presents their findings in turn by describing what they have written down as well as sharing inspiring stories which might spur others to recall another insight that they can share. Focus on description and detail of aspirations, barriers and interesting aspects of your observations. All post-its are arranged on a wall or large visible area. Ideally, this activity occurs several times throughout the data collection process and continues to inform your data collection methods.	Ideation	Data sharing and synthesis	(IDEO.org, 2015, p.77, 78)
Top five	This is a flexible method that can take place at any stage where there is a need to consolidate thinking and draw out next steps. The output of these sessions can serve as a record of thinking over the course of the project.	Ask team members to reflect on what has been discussed and write down their top five ideas, themes, insights, or challenges on separate post-its. This can be part of a broader *Brainstorm and bundle* activity. Be specific about which of these categories you are focusing on. You may also like to further narrow down the activity by specifying a time-frame, such as the top five for the week, or for a particular data collection activity. Sharing then takes place where all team members present their ideas. Go through and rearrange them as a group with the aim to create rich clusters of related insights that may inform the next steps such as *Create insight statements* and *Create a concept.* Label the poster where these are all placed with the specifics of the activity.	Ideation	Data sharing and synthesis	(IDEO.org, 2015, p.79, 80)

Create insight statements	Insight statements serve as an important culminating step moving on to narrow down the focus of the problem solving.	Take the results of the *Top five*, work as a team to create short statements that capture insights that can be taken from each cluster. Refining these insights, eventually discarding all but a handful that relate directly to the design challenge will inform the *How might we* activity. You may also like to ask your customers to reflect on your insight statements to see whether they do in fact reflect reality.	Ideation	Data sharing and synthesis	(IDEO.org, 2015, p.81; example, p.83; template, p.176)
How might we	This activity is about making the problem solving opportunity explicit. It builds on previous *Create Insight Statements* steps to reach a single focus point that will guide the rest of the process.	After you *Create Insight Statements*, take each one and rephrase these as questions. Eventually you may decide to repeat the *Top Five* activity, this time focusing on the top "How might we" statements. This activity can be framed in terms of being able to imagine your ideal world to make the issue more concrete.	Ideation	Data sharing and synthesis	(IDEO.org, 2015, p.85; example, p.87; template, p.177) See also, *Describe the ideal world in the absence of the problem* (Brest et al., 2015, Step 4, p.9)
Create frameworks	A set of tools for representing the system that you are studying and to organise data collections and insights. This is a useful method to use during Data sharing and synthesis when the topic is part of a larger system or related another topic that has arisen. This works well when solving complex challenges that involve different actors, interactions and time-scales. This activity helps visualize patterns, understand different customer perspectives and context.	Have somebody on the team draw patterns as they are being discussed. This can include the use of Venn diagrams or 2x2 matrices. If it becomes clear that there is a process that is emerging from the discussion, use a journey map to show how the customer experiences the problem. A relational map, which identifies how different groups and participants relate to each other, can also help to make sense of areas where you may need to focus attention.	Ideation	Generating ideas	(IDEO.org, 2015, p.89-93)
Brainstorm and bundle	This is a creative and fast-paced way to generate ideas based on the data and insights that the group has discussed so far. The activity requires optimism, welcoming attitudes from	Provide all team members with writing materials and post-its. Pose the question you would like the group to work on, methods such as *Mash-ups* can help. Provide a short time in which everyone works independently to write separate ideas on each post-it. The session then	Ideation	Generating ideas	(IDEO.org, 2015, p.94, 95, 97)

	all team members and a freedom from fear of failure or criticism.	moves to each person explaining each idea as they place it on the whiteboard, wall or poster. Each team member should adopt a mindset in which they defer judgement, encourage wild ideas, build on the ideas of others, stay focused on the topic, and aim for quantity over quality, and visual communication by placing all ideas in open view. Bundle ideas together as a team to see how turn them into possibilities to solve the more complex reality of your problem. Promote active discussion throughout, so that agreement is reached about the similarities, benefits and distinctions of each bundle.			
Mash-ups	This method works well to encourage thinking beyond the current constraints and status quo of the problem that you are trying to solve. It provides a structure for creative thinking by asking participants or team members to come up with ideas in unusual contexts.	The leader of the activity isolates a particular quality that is the focus of the solution. Some examples include efficiency, speed or aesthetics. Write that quality down for all to see. Then think of a business, brand or service that is known for that quality, or does it really well, perhaps in one aspect of their work. Write that down, also. Have the team come up with ideas of what the solution might look like if it were informed by the selected business, brand or service. For example, if you are looking for a way to communicate short and succinct pieces of information. Twitter is an example of a product that does that. The mash-up would ask – what is the Twitter version of [the context you are working in].	Ideation	Generating ideas	(IDEO.org, 2015, p.104)
Design principles and guiding mantras	Use design principles and guiding mantras to ensure that the work of the team is cohesive in its vision. These can serve to bound the work, set the tone of the team's approach and focus attention on the parts of the context that matter the most.	Working from the results of collections of themes created throughout Data sharing and synthesis activities, extract core principles that underlie them. Aim for high-level positive principles that provide opportunities for refinement and exploration, rather than low-level prescriptions that limit the solution unnecessarily and prohibit good ideas from emerging (such as a single location for an event to take place, or a particular model of tablet for a digital artefact). Specifications and refinements of this nature can be made later in the process.	Ideation	Generating ideas	(IDEO.org, 2015, p.105; example, p.107) See also, *Articulate "design mandates" and posit strategies that could transcend barriers, address needs, and facilitate change* (Brest

					et al., 2015, Step 12, p.17)
Create a concept	A way to move ahead from ideas into more polished concepts. The results of this activity are what the team will aim to prototype.	Start with ideas that emerged from the *Brainstorm and bundle* activity. You may need to *Create Frameworks* if you are working with a very complex problem. Move from an idea to a concept – one that describes the solution in enough detail for prototyping. Remember to keep in mind how you chose to *Frame your design challenge* and follow the *Design principles and guiding mantras* to remain on target.	Ideation	Creation	(IDEO.org, 2015, p.108)
Co-creation session	Bring the customers back into the process by inviting them to a co-creation session. This is useful to continue to engage them and can be done after the *Create a concept* activity, so that there is a more solid aim to work towards.	Invite specific customers to participate in a co-creation session in which they work with practitioners on *Prototyping* or a *Brainstorm and bundle* session. Avoid treating this activity as an *Interview*, or as one-sided. Make it clear as well as possible that the outcome of this session can inform the solution. Everyone will be learning from each other.	Ideation Implementation	Creation	(IDEO.org, 2015, p.109)
Storyboard	The storyboard may be used to convey a progressive understanding of the problem, as well as serve as a prototype to describe emerging solutions. It provides an accessible avenue to convey ideas about who will use the solution, where and how. It is also a way to think quite explicitly about the proposed solution and serve as a talking platform for team members as you start to consider finer details of your solution as the project progresses through iterations.	A storyboard uses visual representations to communicate key steps of how your solution will work. You may choose to focus on a particular aspect of your solution. Use a series of individual comic-book style frames with a small space for drawing and a small space for describing what is taking place. To keep the focus on designing for people, start with a persona frame. This will include an image and specific information about your customer including their age, gender, profession and any other pertinent characteristics you wish to include. This is the start of a story you will tell about how this persona will benefit from your solution. In the frames that follow, depict and describe the persona's problem, and how it will be solved in stages by interacting with your solution. Focus on creating quick work that conveys only essential features of the story.	Ideation Implementation	Creation	(IDEO.org, 2015, p.113, 178-179; examples, p.114-117)

Prototyping	Making the solution is key to solving the problem. Prototyping should take place throughout the process using different media and to different degrees of refinement. The aim of prototyping is to learn about what works.	The team should decide on a concept or portion of one to prototype. Next decide on what form the prototype should take. You may use a *Storyboard*, structure the outcome to be a series of visual cue cards to be used in *Game play,* a model that can be talked-through and explained to customers or even a physical product. The form it takes should reflect what you aim to learn from your prototype. Make collaborative decisions about the development of the prototype and be prepared to start from scratch once you *Reflect and redo*. A prototype is not the final solution.	Ideation Implementation	Creation	(IDEO.org, 2015, p.111, 119, 135) You may like to begin this process in a more structured fashion to *Turn the selected strategies into logic models and compare them to one another* (Brest et al., 2015, Step 15, p.20)
Get feedback	Following on from *Prototyping,* this activity is about collecting data and getting reactions about the functionality of the prototype. This is an opportunity to get some quick information and first reactions from your customers.	Decide on aspects of the prototype you would like feedback on. Start with getting overall first impressions, and following a *Reflect and redo* activity, follow up with more specific targets. Identify an appropriate location for testing, ideally the solution context. Weigh up the option to conduct a testing session in a convenient location rather than realistic location in order to maximise the amount of feedback received. This perspective may change at each stage of gathering feedback. Encourage participants to provide honest responses, explaining that negative feedback provides an opportunity for improvement. Use open questioning where more specific advice can be obtained on-the-fly. Following this activity, conduct a Data sharing and synthesis activity.	Ideation Implementation	Testing	(IDEO.org, 2015, p.126)
Ways to grow framework	This activity is designed to provide a quick and visual sense of how difficult the solutions may be to implement. This is done by helping to understand how revolutionary, evolutionary or incremental a solution may be. It can be used to compare several potential and existing solutions.	Use the template provided to plot solutions according to their novelty and whether new or existing users will be adopted. Given their nature, consider whether particular solutions may be more suitable than others. Be cognisant of the organisational culture and other constraints that you have learnt about along the way, especially through the *Double ethnography*.	Implementation	Testing Launching	(IDEO.org, 2015, p.141, template: p.184)

Roadmap	Often referred to as a project timeline, this activity is intended to keep projects on track. It will likely be ongoing throughout several phases of the project.	Follow established organisational standards and procedures for managing project objectives.	Implementation	Testing Launching	Seek advice from a business development unit on project timelines.
Pilot	This activity takes place once a prototype has been developed to the point that the team considers it to be ready to operate as intended in the field and needs to be trialled. The mindset throughout this activity should be one of expecting to *Reflect and redo* – it is unlikely that a pilot will be identical to the completed solution.	The pilot is a way to live test the solution for a longer period of time than might be intended in a *Get feedback* activity. Arrange to pilot your solution in its intended context. It may be useful to *Define success* in order to guide how to collect evidence of how well your solution is working in the field. Use Data collection activities to learn about how well your solution is working.	Implementation	Testing	(IDEO.org, 2015, p.146)
Reflect and redo	Of particular use following prototyping, this is a set of methods to use throughout to continue to receive feedback from the people you are using for, integrating the feedback and iterate.	Your team will come together with results from testing and piloting to prepare to modify the solution. Using a combination of methods that were used earlier in the process, such as *Create frameworks,* and *Brainstorm and bundle*, plan for how you can improve the idea.	Ideation Implementation	Revising and revisiting	(IDEO.org, 2015, p.127, 148, 157)
Define success	A way to orient your team towards success includes coming to a shared agreement about how it should be defined. This can be conceptualised as a series of milestones as well as ultimate functionality.	The *Frame your design challenge* activity will provide a starting point to defining success. Work this into the milestones that you identified in the *Roadmap* to build more specific success criteria at different stages of the project. These definitions can also be used when you *Get feedback* to find out whether you are on track.	Implementation	Testing Launching	(IDEO.org, 2015, p.147) See also, *Prioritize and narrow the range of your intended beneficiaries* (Brest et al., 2015, Step 6, p.11)
Monitor and evaluate	Plan to evaluate the efficacy and monitor progress of the solution in operation. This is key, even when the solution is "final" to ensure that work that has gone into producing the solution is responding to customer needs.	The Department has a series of established practices relating to the evaluation of programs which can be used for these purposes. Use the output from the *Define success* activity to guide what you measure.	Implementation	Revising and revisiting Testing	Consult the evaluation team and refer to the departmental Evaluation Framework.

Table 1. Human-Centred Design methods

How might HCD be used in the field of education?

Human-Centred Design could help to solve problems in policymaking, classrooms, teacher professional development and education research.

A constant feature throughout the process is that it be informed by research derived from customers, whether it is during the initial inspiration phases, reflecting on the results of a prototype to inform iteration or planning for implementation. While the narrative structure of the framework presented in Table 2 connotes a linear process, it is expected that each project will take its own path. Some activities have natural precursors, others may be conducted in parallel or skipped altogether. There is also the expectation that many activities will be revisited throughout – prototyping and testing quickly and often is key to breaking down the fear of failure that can stifle innovative solutions.

In many cases, the best tools to use are most basic: pens, pencil, paper, post-its, butcher paper, whiteboards, posters, and different coloured media to reflect different categories and significance. Since iteration is built into the process, the use of low fidelity media makes it is easy to build on ideas without concerns about presentation or use of resources. It also establishes a flatter relational dynamic; each contribution is as visible and therefore validated as being as valuable as any other. By providing each team member with the same tools that allow for contributions to materialise instantly, it is much more difficult to discount contributions without first acknowledging them. It is also enables ideas to be shared immediately and rearranged as needed for each activity. Post-its are particularly useful in this sense, because they allow for a neutral platform through which to compile ideas, group them and rearrange as needed. They also allow for ideas to be placed where they need to be seen to be worked from and provide a consistent reference point.

The use of digital artefacts, such as video recordings, audio recordings, photos, word documents, webpages and interactive devices such as tablets may also be incorporated. For alternative conceptualisations of how the work of Human-Centred Design may be used by organisations, see the related concepts are available in Appendix A.

Human-Centred Design could be used in work characterised as:

- Project-based
- Requiring long-term planning and investment
- Resource-intensive
- Involving the design of a solution that will impact other processes and workflows
- Communication-intensive
- Impacting a number of stakeholders with a diversity of views and responsibilities
- Complex or “wicked”
- Multidisciplinary.

HCD for Government and policymakers

Human-Centred Design can help public institutions and policymakers explore new and better ways of doing business. Public institutions exist to provide public value, as authorised by the electorate (Moore, 1997). This view is situated within the NSW Government's 2020 plan and open government models which adopt the position that Government does not always know how best to serve the public and to meet the needs of its constituents. In fact, public institutions are about more than delivering public value, they are about creating public good.

Value is something that can be co-created with customers. One way to be more responsive to the needs of customers is to use an "outside-in" approach, where practices are responsive to the changing needs and context of customers. This is in contrast to a more traditional "inside-out" approach that assumes that the best solutions are already known by the organisation that delivers them.

Fulfilling expectations and providing public value are good. Innovating beyond these expectations is even better and relies on creative solutions that diverge from current expectations.

Government institutions do business with a range of individuals and groups that are provide with a service as well as with stakeholders or those providing advice. Business relationships fall into the following broad categories relating to the degree and nature of reciprocity, whether services result in financial or in-kind transactions, and the legislative and policy context.

- School communities, teachers, and principals
- Commercial entities, such as technology vendors and banks
- Non-profit organisations such as charities and service providers
- Educational research and training institutions such as universities, course providers, research organisations and non-government education sectors
- Other government agencies
- Internal corporate units
- Advocacy groups and professional associations

Expectations placed on government employees vary between activities. Arriving at solutions that address this characteristic diversity is particularly well suited to the Human-Centred Design approach.

It is particularly useful for improving customer service. Human-Centred Design is a way to provide insights into customer need by providing a framework to achieve solutions that intersect the desirable, viable and feasible realms of a problem space, represented in Figure 2. Given that empathy is the central mindset of this approach, it is naturally conducive to better understanding customers. Empathy elucidates the desirable aspects of a solution, which are usually uncovered during the inspiration phase of the process. Human-Centred Design is also able to incorporate the viable and feasible components of a solution – these mean that customer service can be improved by relating it to the real-life business demands and technology or resource constraints that

are faced by an organisation. The viable and feasible aspects of the problem space are usually uncovered during the ideation and implementation phases of the process.

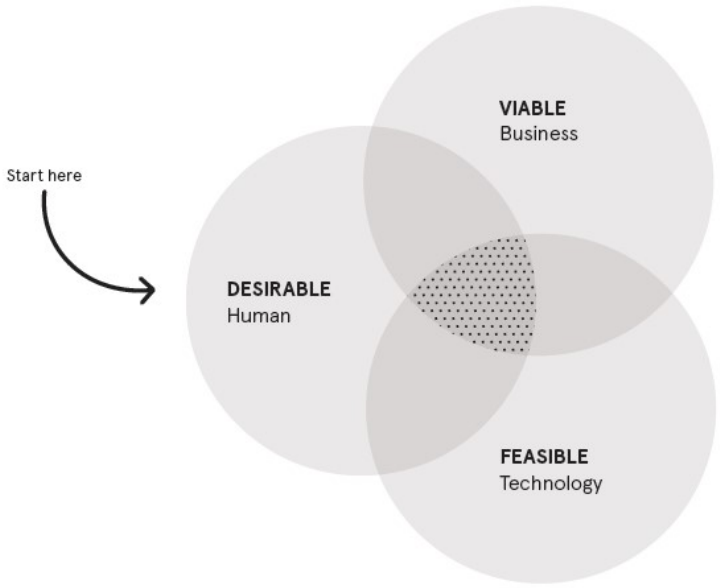

Figure 2. Impact potential of Human-Centred Design (IDEO.org, 2015).

The application Human-Centred Design methods requires a holistic approach which will ensure that activities are not used in isolation but integrated into a meaningful and goal-directed process. A process for using Human-Centred Design for Government and policymakers is presented in Table 2. The methods shown as bolded and highlighted text and are grouped by Collections – conceptual groupings that may support Human-Centred Design teams by providing them with language that is more likely to be familiar.

Inspiration

1. Organisation and planning

Frame your design challenge.
Create a project plan where you will be ***Identifying the right people (project team).***

2. Data collection

Conduct ***Secondary research*** to help you with ***Identifying the right people (participants and customers).***
You will need to use ***Interviews*** at several points and in different ways throughout the research.
You will choose from additional methods such as ***Immersion, Analogous inspiration, Card Sort, Game play, Peers Observing Peers*** and ***Double ethnography***

Ideation

3. Data sharing and synthesis

Download and share what you have learned from data collection, refining by identifying the ***Top five*** that you can use to ***Create insight statements*** which can be rephrased into ***How might we questions*** that guide the rest of the work.

4. Generating ideas

Stimulate creativity through ***Brainstorm and bundle*** activities, which may incorporate techniques such as ***Mash-ups.***
When grappling with complexity, ***Create frameworks*** which can be used to inform ***Design principles and guiding mantras.***

5. Creation

Move from ideas to ***Create a concept*** that can be used for ***Prototyping*** as well as put to use in a ***Co-creation session.***
You may like to use a ***Ways to grow framework*** if deciding between several possible solutions.
Communicate concepts using a ***Storyboard*** which can later be used in…

Implementation

6. Testing

Get feedback at several stages of the process.
You will likely revisit ***Identifying the right people (project team)*** and prepare to ***Pilot.***

7. Revising and revisiting

Throughout the process will be opportunities to ***Reflect and redo***, guided by ***Design principles and guiding mantras.***

8. Launching

Be guided by how you ***Frame your design challenge*** to ***Define success***. This may be helped by the use of a ***Roadmap*** which should provide scope for ongoing activities to ***Monitor and evaluate*** your solution.

Table 2. Human-Centred Design process for Government and policymakers

Revised business process

In trying to understand how best to collaborate with the groups and individuals that we do business with, Human-Centred Design provides a process for identifying need and building buy-in to the ultimate outcome by including stakeholders in the development process.

One successful example of this is the nurse knowledge exchange (Lin, Hughes, Katica, Dining-Zuber, & Plsek, 2011). A network of hospitals in the United States sought to address the problem of how nurses communicated information between shifts and completed handovers. The initial solution failed because it had not involved users (medical staff), in its design. The product did not fit their needs and required behavioural changes that were too extensive a departure from their norm. In response, a Human-Centred Design approach was used to design, implement and scale The Nurse Knowledge Exchange following a series of mini-trials and extensive field observations and continuous iteration. This "soft start" approach was credited with the ultimate success of the finished product, since it had the buy-in from end users.

HCD in the classroom

Bereiter and Scardamalia (2008) distinguish between pedagogies that ask questions in "belief mode" or "design mode". The kinds of questions asked in belief mode are:

> What does this statement mean?
> Is it true?
> What is the evidence?
> What are the arguments for and against?

According to Bereiter and Scardamalia (2008), this form of questioning is historically dominant in curricula, yet knowledge is created by moving back and for the between belief and design questions. There are benefits to including questions in design mode, such as:

> What is this idea good for?
> What does it do and fail to do?
> Does it have a future?
> How could it be improved?

Applying Human-Centred Design in the classroom is a way to flow between "belief mode" and "design mode".

Several examples of the potential for Human-Centred Design in the classroom are provided below. A practical resource for educators is available at the Design Thinking for Educators website (IDEO.org, 2012).

Designing digital learning tools

Given Human-Centred Design's affinity with user research, the methodology is a close evolution of those likely already being used by the designers and developers of digital learning tools. One study demonstrated that Human-Centred Design can be used for the design of computer-supported collaborative tools (CSCL; Leinonen & Durall-Gazulla,

2014). The authors suggest that CSCL can be seen as a wicked problem – those which are complex, open-ended and intractable (Australian Public Service Commission, 2007; Head, 2008) – and one which is well-suited to Human-Centred Design approaches. Attention is focused at five levels: design details, user interface, systems, social issues and broad societal implications (Leinonen & Durall-Gazulla, 2014). Interestingly, the authors did not identify the learning content as a layer – given that different tools are appropriate for teaching different learning content (think, for example, of pedagogies as tools (Bereiter & Scardamalia, 2008; van den Broek, 2012), this is an unexplained omission.

Informing the design of learning spaces

Sherringham and Serle (2011) demonstrate how visual action methods can be used to design learning spaces in the higher education context. In particular, that of "next generation" learning environments. They argue that change requires the adoption of frameworks that are participatory, inclusive and appreciative, that support change through the co-creation by stakeholders of shared visions of their future. They consider that this necessitates methods that interrupt normative, habitual patterns of thinking, such as human-centred visual action methods (Sherringham & Serle, 2011). The authors discuss participatory methods that promote the use of play and imagination to distance participants from their current constraints; they are based on the creation of a visual dialogue that disrupts the dominant and esteemed text-based forms of expression. Practices include the use of visual cue cards and probes to stimulate discussion, role-playing, and the generation of new meaning through adoption of imaginary personas. Exploratory physical activities, such as those suggested by Sherringham and Serle (2011) are considered to be important in the production of novel ideas, especially when they occur in a playful environment that encourages risk-taking, suspension of premature judgment, tolerance of ambiguity and an appreciation of ideas from broad perspectives (Oviatt, 2013). These environmental characteristics align well with the mindsets that are necessary for the implementation of Human-Centred Design.

Encouraging students to adopt positive mindsets

One of the findings summarised by a literature review on Human-Centred Design highlighted that its intrinsic values are commensurate with the values that we aspire to inculcate in our students, particularly in the context of preparing them for a rapidly changing and unpredictable future (Foundation for Young Australians, 2015). Specifically, the design process teaches students skills to "identify needs and define problems; reflect individually and collaborate with a group; test ideas and evaluate alternatives; make abstract concepts tangible; communicate verbally and visually; and see meaningful connections across disciplines") that are important for engaged citizenship because they require an understanding of perspective and agency in shaping environments and communities (Drake, Cerminaro, & Drenttel, 2011). From a socio-emotional perspective, students are also likely to benefit from the methods of Human-Centred Design. A study on the effects of the practice of prototyping found that participants reframed failure as an opportunity for learning, were able to sense progress and had improved beliefs about their creative abilities (Gerber & Carroll, 2011).

HCD for teacher professional development

As one of the largest employers in Australia, the NSW Department of Education has a wide-ranging and deep level of in-house expertise. However, it could be said that the house has so many rooms that it can be difficult to know just how to find the right person to collaborate with, although you know the people in your own room very well. Finding a way to make these intricate knowledge and relationship connections visible is a complex problem.

Designing a knowledge management platform

A knowledge management platform, such as that described by Pascal, Thomas and Romme (2013) is one example of a solution that arose through Human Centred Design to address a similar issue. Interestingly, Human-Centred Design was combined with Science-based design (refer to Appendix B) for the successful creation of an interactive map of competencies to enhance knowledge exchange at a telecommunications and information technology park. In this example, the project was intended to provide a solution where individuals working in this industry cluster would be able to identify people with whom they could collaborate and partner.

HCD for research

The association between design and research is inherent to the applied sciences and engineering; the same cannot be assumed about the field of education research (Bereiter & Scardamalia, 2008). There is potential for Human-Centred Design to bridge this gap between theory and practice by treating issues not only in "belief mode" but also in "design mode".

Human-Centred Design has the potential to disrupt the hierarchy of authority that academia and research sustains. The collaborative nature of Human-Centred Design, whereby a team is composed of both practitioners and users, creates a blurring between the expert/novice division; the mainstay dichotomy of traditional research. The positioning of the research "subject" as a source of knowledge creates an interdependency between researcher and the researched. A frequent reversal of the roles of novice and expert throughout the course of the project facilitates mutual understanding of respective ideologies which is necessary to conduct collaborative projects, such as ARC linkages. In such situations, Human-Centred Design can be used to address one difficult aspect of large scale multi-stakeholder efforts: internal communication.

Developing communication plans for projects that involve multidisciplinary teams

The establishment of multidisciplinary teams is prone to the complexity that arises from differing priorities, "world views" and users. A communication plan would attempt to bring all participants onto the same train of thought to establish common goals by understanding the drivers for the distinct points of view of each party.

One example comes from a study that demonstrated the need to design a communication strategy to coordinate the use of research findings within a broader

Human-Centred Design problem solving context. Since Human-Centred Design relies on user research data and observations to guide design decisions, the ability to communicate research findings to the project team and to keep this knowledge relevant throughout the process is crucial. This communication effort can be envisaged as a micro-HCD project within a broader HCD context. In these cases, the use of *double ethnography* is considered to be a particularly useful technique (Roschuni et al., 2013). The researchers suggest the following techniques to address communication issues: investigate the research environment with a double ethnography approach, focus on sites of inertia, facilitate the actionability and socialisation (of research findings) by supplementing traditional project documentations with experiential learning.

How is Human-Centred Design different to what we do already?

It is plausible to think that work conducted in the field of human services and social sciences is *de facto* human-centred. It may be less plausible to consider this to be *design* work.

While policymakers, teachers and researchers may be required to solve problems for people, the process by which they arrive at those solutions determine whether these solutions are human-centred. Treating problem-solving as a design challenge, establishes a further distinction.

While other problem solving strategies may involve the user at some stage, the success of a human-centred strategy depends on the importance that their involvement is given and the manner that users are engaged. One example is the common practice of consulting with stakeholders as part of project work – consultation is not by default human-centred, although it has the potential to be.

A human-centred approach would *start* with the customer or stakeholder even before a clear picture of the problem to be solved has emerged. It makes no initial assumptions about the current state of affairs; instead it seeks to uncover these to understand the problem as it is experienced by the customer. The user is placed in prime position throughout the process as a source of inspiration; all decisions are guided by their needs, limitations and context, which are kept at the fore throughout the entire design process. Introducing the user part of the way through the problem-solving process, or using their data at only a particular stage of the process does not constitute Human-Centred Design.

The manner in which customers are engaged is another key aspect of Human-Centred Design, which uses methods that are qualitative, holistic and ethnographic. Emphasis is placed on developing a relationship with the customer that is empathic, so that practitioners are able to get as close as possible to understanding the lived experience of the customer. Interacting with the user solely to advance design work without an interest in empathic understanding is not Human-Centred Design (Stoker & John, 2009).

This holistic approach can often mean that stakeholders who are not the beneficiaries or intended users of the product are involved since they are able to provide insights into contextual factors that may impact on the customer. The identification of analogous situations is also a source of inspiration, as a way to think "outside the box" or indeed outside the constraints of the current state of affairs. These attempts seek to ask what we can learn from other contexts which may have characteristics in common with the one that we are working with – it may be a case of avoiding a recreation of the wheel.

Even the term "user-centred design" does not adequately capture the intent of Human-Centred Design. A user-centred approach restricts the focus on people's roles as users, rather than allowing this definition to emerge (Steen, 2011). This can be understood by appreciating that the problem space of Human-Centred Design is often not known until a contextual analysis of the situation is undertaken; it is through this contextual analysis that users of a solution can be identified and held at the forefront of the design effort. A

research participant who is not defined as a user is still potentially very important to incorporate into the research, since they may provide contextual information.

The architecture of Human-Centred Design differs from the linear, milestone-based processes typical of academic research; this can feel chaotic to those experiencing it for the first time (Brown, 2008). Human-Centred Design is necessarily iterative and is so in a way that cannot be prescribed from the outset of a project. The iterative nature of this approach reflects a focus on rapid prototyping, which requires the need to engage with customers, revisit research findings, identify new areas of need and test the proposed solutions quickly and informally.

Human-Centred Design offers the potential to address different aspects of the same problem, ranging from physical interactions through to metaphysical questions about meaning ascribed to a product or service. Giacomin (2014) conceptualises this potential as a system of inquiry spanning the physical-metaphysical continuum, show in Figure 3. Design solutions that respond to concerns higher up the pyramid offer a wider range of affordances and the potential to create a deeper impact.

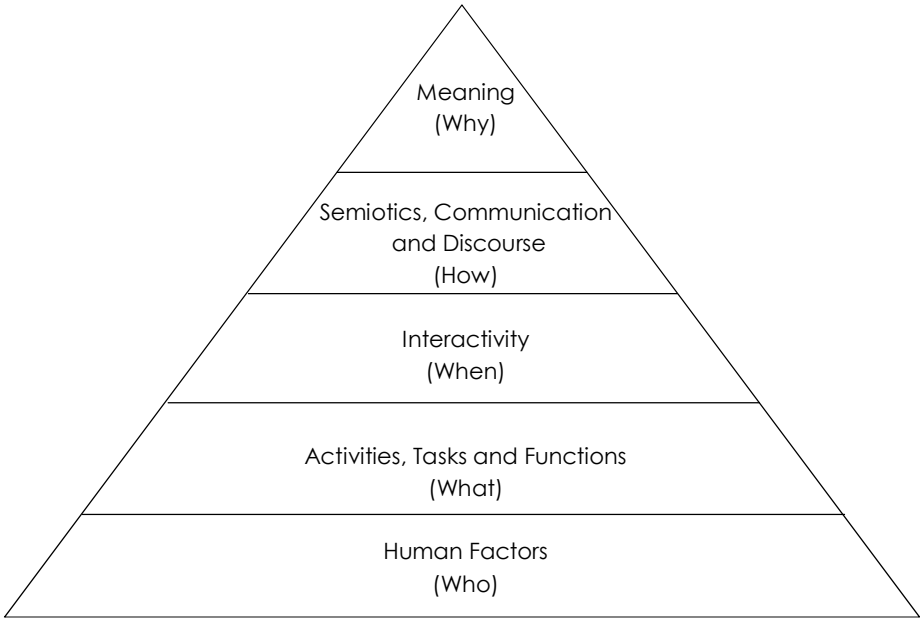

Figure 3. The Human-Centred Design pyramid (adapted from Giacomin, 2014)

Alternative problem-solving approaches to Human-Centred Design may provide a better fit for solving particular problems or achieving a solution that fits better with the a project's goals. Alternatives include Citizen-centric approach, Science-based design, Environmentally sustainable design and Technology-driven design. For a detailed discussion of these approaches, please refer to Appendix B.

Conclusion

Human-Centred Design is a problem-solving approach that can be used in the field of education. This paper has outlined a process and provided examples which demonstrate some of the potential of Human-Centred Design.

Not all issues can be addressed with Human-Centred Design; it should be considered one tool in the problem-solving toolkit. Founded on empathic methods and offering a connection between theory and practice, Human Centred Design has an affinity with the values of education and the field of human services more broadly, which aims to serve users, customers and stakeholders in ways that focus primarily on human needs.

Appendix A. Related concepts

There are related concepts which intersect or are sometimes used with the same intent as Human-Centred Design. These provide alternative frameworks from which to apply this approach.

Frameworks

Human-Centred Design has been presented as a framework of methodological approaches, each of which may be more or less suited to the particular characteristics of the project and problem space (the area between the current and ideal situation). In the examples, below, the actors involved in Human-Centred Design, the role they play in the process and the nature of their interactions inform the framework for determining the particular approach to be adopted.

Tensions

Steen (2011) bounds Human-Centred Design approaches between the dimensions of discipline (between research and design) and actor (users and Human-Centred Design practitioners). The appropriate approach needs to be matched to the particular needs of the project. Figure 4 represents this methodological space.

Participatory design and co-design are intended to reflect a wide range of methods – the former in which users of the product help to design it and the latter reflects the collaboration between ranges of stakeholders in designing a product.

The lead user approach focuses on a select group of innovative users who currently use the product or similar products but in ways that express insights into the potential needs of a larger use group, in the future.

Empathic design typically involves observing users, role-playing, visual diaries and other probes that encourage others to record their experiences and thoughts.

Contextual design is primarily concerned with the observation of people in their natural environment to understand what people actually do, how they communicate, the exercise of power and the role of culture, the artefacts that people use, and people's physical environment. A challenge here is being able to separate what Human-Centred Designers know *about* users to what they know *from* users.

Ethnography is characterised by field studies that aim at a holistic picture of how people and their actions are embedded in social and cultural contexts and how this relates to their creation of meaning.

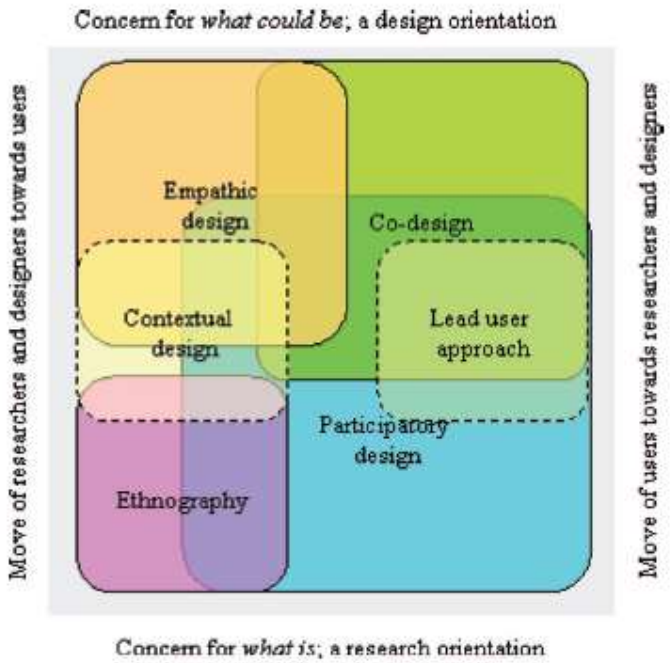

Figure 4. Different Human-Centred Design approaches, with different starting points and emphases (Steen, 2011).

Design Contribution Square

The Design Contribution Square has similarly been used to map different Human-Centred Design approaches by representing each according to the degree of proactive initiative required on the part of users and designers during design collaboration (Keinonen, 2009). The five identified approaches are do-it-yourself design – using similar principles to those described for Lead User approach (Steen, 2011), co-design, user-centred design, reflective design (similar to empathic and contextual design) and silent design (where design knowledge is mediated by design proposals without the active participation of users or designers). Keinonen (2009) argues that the selection of approach should depend on the proactive, reactive or inactive roles of the user and designer engaging in Human-Centred Design, with a preference for guiding design interactions towards proactive contributions from both types of actors. The Design Contribution Square is intended to be an instrument which focuses on users and designers' engagement styles as a way to plan Human-Centred Design activities; shown in Figure 5.

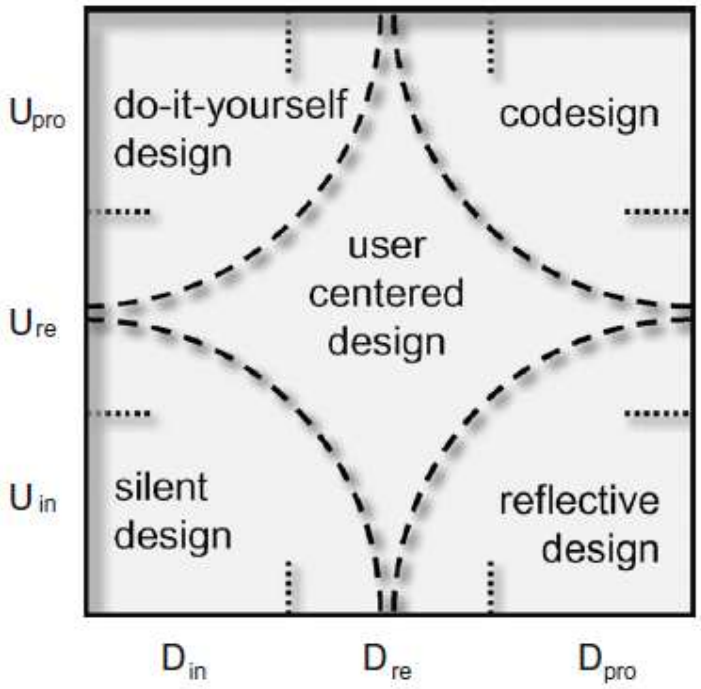

Figure 5. Human-Centred Design approaches positioned on Design Contribution Square (Keinonen, 2009).

Appendix B. Other problem-solving approaches

Citizen-centric approach

A recent report by the McKinsey Center for Government, Singapore, presents the citizen-centric method for delivering government services (Dudley, Lin, Mancini, & Ng, 2015). The authors present four elements of implementing transformation efforts aimed at increasing citizen satisfaction and reducing costs.

1. **Measuring citizen satisfaction.** The authors recommend using indirect survey methods that analyse break points (at what point service satisfaction drops) and combining this with internal metrics and employee insights to indicate weaknesses in current service delivery.
2. **Getting a detailed understanding of the entire citizen journey.** This is described as the entire journey that a person has when seeking a government service. The authors recommend focusing on the journeys that matter most to citizens, mapping out in detail what is involved in each of these journeys, identifying the internal processes that shape these journeys
3. **Translating improvement opportunities into front- and back-end solutions**. Provide notifications and status updates so that citizens have a more transparent understanding of operations and increase the ability for self-servicing. Also ensure that communication is polite, consistent and professional.
4. **Thinking long term.** This is done by increasing the capability to manage and measure performance at points along the journey that are not currently available and building a governance system that is accountable and that models policy and operations separately.

This method is based on listening to citizens to improve services yet it is based on a distasteful target of mediocrity; the underlying message of the report is that government should aim to meet customer expectations without seeking innovative improvements to deliver a service that is beyond these expectations. This message is commensurate with the focus on cost-reduction and with avoiding disappointment as opposed to stimulating innovation and achieving satisfaction. This corporate vision conveys an antipathy towards government reflected in the suggestions provided to reduce its reach and impact.

An alternative approach would instead view the customer as a source of inspiration, not a burden to be endured and a potential risk to be minimised. This valuing also extends to the design team, who are tasked with imagining new futures through the detailed analysis of research data and the subsequent generation of concepts beyond the imagination or current reality of any one user.

This requires a deeply empathic approach to understanding how the daily experience of navigating our institutional structures connects and interplays with the customer's broader experiences and societal context.

Human-Centred Design offers the conditions to operate in such a problem-solving environment by providing a natural home for this contextual and empathic inquiry combined with optimism and imagination.

Science-based design

The abductive and experimental nature of Human-Centred Design is at odds with the inductive and deductive practices of science-based design, although the two approaches have been shown to be combined effectively (Pascal et al., 2013).

Science-based design uses the approach of grounding design propositions in research and testing them systematically in practice. Science-based design has a strong interest in developing explanatory and prescriptive knowledge that serves to improve professional practice. Users need a thorough understanding, both of the rule and the particulars of the specific case and they need the skills to translate general into specific. The main differences between the methods arise from the degree to which users are able to influence the design process.

An integrated design approach is proposed, practical and scientific knowledge are combined. This iterative methodology involves the activities of creating problem awareness, developing design propositions, creating scenarios of use, design and developing artefacts, experimentation with prototypes and organisational transformation.

Environmentally sustainable design

Giacomin (2014) considers that environmentally sustainable design is one of three major design paradigms that frame the work of contemporary designers. This type of design prefaces planetary impact over and above human meaning, as with Human-Centred Design, and above technical novelty, which is characteristic of technology-driven design.

The environmentally sustainable design paradigm highlights one of the limitations of Human-Centred Design: its anthropocentrism. If the emancipatory potential of design is conceived as a manifestation of our moral obligations, Human-Centred Design implicitly accords humans beings the source of value judgments about how best to live; how best to interpret need and respond to it.

Value can more broadly be understood as deriving from life including and beyond the human realm. Stevens (2015) argues that life has value because life has intrinsic purpose. Human-Centred Design stops short of being able to engage with this purpose because it focuses on the needs of human beings. An evolution of this paradigm would conceptualise how life more broadly may participate in this problem-solving approach by extending empathy to non-human life.

Technology-driven design

Human-Centred Design is considered to be particularly effective at incremental innovation which builds and improves on what already exists (Norman & Verganti, 2012). In contrast, radical innovation, characterised by complete departure from the current

state of affairs and accepted practices is considered to be ill-suited for the Human-Centred Design problem solving approach.

Radical innovation comes from changes in either technology, as driven by inventors, or through research that addresses fundamental questions of new meanings and their interpretation. Radical innovation occurs without any design research or formal analysis of needs. However, once radical innovation had been developed then Human-Centred Design is invaluable as a way of improving the outcome, especially to transform the radical idea into a form that is acceptable to those beyond early adopters (Norman & Verganti, 2012).

Economist Brian Arthur suggests that some of the most revolutionary devices of the 20th Century were not driven by user needs but by the evolution of earlier technologies, driven by science, advances in engineering and tinkerers; user need is a notably absent driver (Norman, 2010).

According to Norman and Verganti (2012), the reason that Human-Centred Design is not considered to be amenable to the production of radical innovation is related to the nature of the process. The process starts with an analysis of user needs, a search for technologies or methods that can better satisfy them and then an iterative process of rapid prototyping and testing, each cycle developing a more refined, more complete prototype. Since users are predisposed to reflecting on what they already know and their current meanings, reflection can lead to improvements but not necessarily radical innovation. The authors consider this predisposition to be a fundamental limiting characteristic of Human-Centred Design.

Three problems exist with this view. First, the version of Human-Centred Design presented by Norman and Verganti (2012) is narrow in its view of the role of the user in the research process and in its understanding of potential solutions. There is no emphasis placed on the participatory nature of data collection – instead, research is "done" to the user. Data analysis is similarly limited to an identification of existing "better" solutions, rather than the creation of new solutions; and interactions are limited to existing semantic and cognitive frameworks (Giacomin, 2014). This narrow view of the user and of potential solutions is more closely aligned with user-centred system development design, outlined by international standards such as ISO 9241-210 "Ergonomics of human-centred system interaction". ISO 9241-210 describes Human-Centred Design as "an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques". Since designing for a "user" usually involves optimising the existing characteristics of the product, system or service based on a set of fixed preconceived plans, this is characterised by limited degrees of interactivity, exploration and learning (Giacomin, 2014). Yet there are plenty of human-centred research methods which overcome these limitations resulting from being too close to the problem such as the study of analogous contexts. The use of inclusive and empathic methods, which treat the user as a participant rather than an object of study can lead to more creative and meaningful solutions.

The second problem with this view is the failure to value the role of the Human-Centred Designer as the ideator, as discussed earlier in relation to the report by Dudley et al.

(2015). It is the role of Human-Centred Design practitioners to bridge the gap between researchers and designers on one side, and users on the other side, so that knowledge and ideas of all participants can be brought together constructively. This ideation process is critically collaborative and relies on design teams with diverse disciplinary backgrounds.

Rather than treating this as a *de facto* limitation of Human-Centred Design, other authors present this tension as the very challenge of Human-Centred Design which can produce such effective results. Steen identifies two tensions: the need to combine and balance users' knowledge and ideas with the human-centred practitioner's own knowledge and ideas; and need to combine and balance a concern for understanding current or past practices with a concern for envisioning alternative or future practices (Steen, 2011). These can be conceptualised as sources of irreconcilable yet productive creative tension rather than limitations.

Thirdly, this discussion and the examples provided by the authors are limited to the realm of technology and product development; they are less applicable to system or social design.

Regardless of these points of contention, this discussion highlights the reason for adopting technology-driven design over Human-Centred Design as the degree to which an intended solution should relate to normative expectations. Human-Centred Design should be adopted in instances where an incremental innovation is being sought, whereas the dramatic breakthroughs that constitute radical innovation are considered best achieved by technology-driven design.

References

Australian Public Service Commission. (2007). *Tackling Wicked Problems: A Public Policy Perspective*. Retrieved from Canberra:

Bereiter, C., & Scardamalia, M. (2008). Towards Research-based Innovation *Innovating to Learn, Learning to Innovate* (pp. 67-91). Paris: OECD.

Brest, P., Roumani, N., & Bade, J. (2015). Problem Solving, Human-Centered Design, and Strategic Processes. *Stanford PACS, May*.

Brown, T. (2008). Design Thinking. *Harvard Business Review, June*, 84-92.

Brown, T., & Wyatt, J. (2010). Design Thinking for Social Innovation. *Stanford Social Innovation Review, Winter*, 30-35.

Drake, C., Cerminaro, D., & Drenttel, W. (2011). *Design and the Social Sector: An Annotated Bibliography*. Retrieved from Hamden, CT:

Dudley, E., Lin, D.-Y., Mancini, M., & Ng, J. (2015). *Implementing a citizen-centric approach to delivering government services*. Retrieved from Singapore:

Foundation for Young Australians. (2015). *The new work order: Ensuring young Australians have skills and experience for jobs of the future, not the past*. Retrieved from Melbourne, VIC: http://www.fya.org.au/wp-content/uploads/2015/08/fya-future-of-work-report-final-lr.pdf

Gerber, E., & Carroll, M. (2011). The Psychological Experience of Prototyping. *Design Studies, June 2011*.

Giacomin, J. (2014). *What is Human Centred Design?* Paper presented at the 10º Congresso Brasileiro de Pesquisa e Desenvolvimento em Design, São Luís, Brazil.

Head, B. (2008). Wicked Problems in Public Policy. *Public Policy, 3*(2), 101-118.

IDEO.org. (2012). Design Thinking for Educators. Retrieved from http://www.designthinkingforeducators.com/

IDEO.org. (2015). *The Field Guide to Human-Centered Design* Retrieved from http://www.designkit.org/resources/1 Retrieved from http://www.designkit.org/resources/1

Keinonen, T. (2009). Design Contribution Square. *Advanced Engineering Informatics, 23*(2), 142-148. doi:10.1016/j.aei.2008.10.002

Lee, J.-J. (2011). The True Benefits of Designing Design Methods. *Artifact, III*(2), 5.1-5.12.

Leinonen, T., & Durall-Gazulla, E. (2014). Design Thinking and Collaborative Learning. *Comunicar, 21*(42), 107-116. doi:10.3916/c42-2014-10

Lin, M. C., Hughes, B. L., Katica, M. K., Dining-Zuber, C., & Plsek, P. E. (2011). Service Design and Change of Systems: Human-Centered Approaches to Implementing and Spreading Service Design. *International Journal of Design, 5*(2), 73-86.

Moore, M. H. (1997). *Creating Public Value – Strategic Management in Government*. Cambridge, MA: Harvard University Press.

Norman, D. A. (2010). Technology first, needs last: the research-product gulf. *Interactions, 17*(2), 38-42. Retrieved from http://jnd.org/dn.mss/technology_first_needs_last.html

Norman, D. A., & Verganti, R. (2012). Incremental and Radical Innovation: Design Research Versus Technology and Meaning Change. *Design Issues, March*.

Oviatt, S. (2013). *The design of future educational interfaces*. New York: Routledge.

Pascal, A., Thomas, C., & Romme, A. G. L. (2013). Developing a Human-centred and Science-based Approach to Design: The Knowledge Management Platform Project. *British Journal of Management, 24*(2), 264-280. doi:10.1111/j.1467-8551.2011.00802.x

Roschuni, C., Goodman, E., & Agogino, A. M. (2013). Communicating actionable user research for human-centered design. *Artificial Intelligence for Engineering Design, Analysis and Manufacturing, 27*, 143-154.

Sherringham, S., & Serle, S. (2011). Using Visual Action Methods in the Research Process. *The International Journal of Interdisciplinary Social Sciences, 5*(10), 370-385.

Sklar, A., & Madsen, S. (2010). Design for Social Impact. *Ergonomics in Design, 18*(2), 4-5.
Steen, M. (2011). Tensions in human-centred design. *CoDesign, 7*(1), 45-60. doi:10.1080/15710882.2011.563314
Stevens, R. (2015). *Eco Ethics*. Sydney.
Stoker, G., & John, P. (2009). Design Experiments: Engaging Policy Makers in the Search for Evidence about What Works. *Political Studies, 57*(2), 356-373. doi:10.1111/j.1467-9248.2008.00756.x
Thomas, J., & McDonagh, D. (2013). Empathic design: Research strategies. *Australas Med J, 6*(1), 1-6. doi:10.4066/AMJ.2013.1575
van den Broek, G. S. E. (2012). Innovative Reserach Based Approaches to Learning and Teaching. (EDU Working paper 79).