

Human-centred design to empower ‘teachers as designers’

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Abstract

Educators of all sectors are learning designers, often unwittingly. To succeed as designers, they need to adopt a design mindset and acquire the skills needed to address the design challenges they encounter in their everyday practice. Human-centred design (HCD) provides professional designers with the methods needed to address complex problems. It emphasises the human perspective throughout the design lifecycle and provides a practice-oriented approach, which naturally fits educators’ realities. This research reports the experiences of educators who used HCD to design ICT-based learning activities. A mixed methods approach was used to gauge how participating educators experienced the design tasks. The perceived level of difficulty and value of the various methods varied, revealing significant differences between educators according to their level of knowledge of pedagogy frameworks. We discuss our findings from the vantage point of educators’ pedagogical beliefs and how experience shapes these. The results support the idea that HCD is a valuable framework for educators, one that may inform ongoing international efforts to shape a science and practice of learning design for teaching.

Keywords

learning design, human-centred design, learning design studio, design framework, design lifecycle

Practitioner notes

What is already known about this topic

- The role of design in education is gaining attention.
- Educators are de-facto designers but lack sufficient knowledge of design processes and methods.
- The studio-based teaching concept fits naturally with teaching human-centred design (HCD).

What this paper adds

- Insights in the application of the HCD process and methods in a teacher training environment.
- Insights in how to support educators in acquiring a design mindset.
- Insights in how educators perceive HCD as a process and insights in HCD methods.

Implications for practice and/or policy

- For learning design researchers: directions in which way they can further advance their field.
- For learning design practitioners: considerations on how to support educators in acquiring a design mindset and design skills.
- For policymakers and educational institution administrators: guidance for setting up teacher professional development.

Introduction

It is commonly accepted that educators (teachers) are designers of learning opportunities (e.g. Bennett, Agostinho, & Lockyer, 2016; Laurillard, 2012). Much as in design generally, teaching is a highly complex activity that draws on many kinds of knowledge (Mishra & Koehler, 2006). Also, teaching occurs in ill-structured, dynamic environments and, as a result, deals with so-called wicked problems (Conklin, 2015). Also as in design, teaching is iterative: there is continuous enactment and subsequent tweaking of activities and resources (Sloep, 2013). Despite these similarities, little research has been devoted to the potential benefits that a design stance may have for the design of learning (Carvalho & Goodyear, 2017). This paper focuses on a particular approach to design: human-centred design (HCD). *Our key hypothesis is that the design practices of educators will benefit from incorporating HCD practices.*

Human-centred design (HCD) is a design philosophy which emphasises a holistic approach to design, aiming to humanise design (Norman, 2013). It provides professional designers with both a process and methods to address complex (wicked) design problems. HCD is practice-oriented, context-aware, empathetic and works incrementally.

Since established design professions have methods that have proven to be useful in educational practice (Carvalho & Goodyear, 2017; Goodyear, 2015), we believe that HCD can provide educators with the design skills they are reportedly lacking (Mor, Craft, & Hernández-Leo, 2013). This is reinforced by the idea that educators could easily adopt HCD-inspired methods and practices by conceiving of themselves

as learning designers and focusing on the practical process of devising effective learning experiences (Beetham & Sharpe, 2013).

In this paper, we focus on teachers' pedagogical beliefs and experiences, as there is a strong relationship between those and teachers' instructional decisions, planning and classroom practices (for details, see Kreijns, Vermeulen, Kirschner, Van Buuren, & Van Acker, 2013). Teachers' beliefs are often deeply rooted and may operate at an unconscious level. Some authors argue that teachers' beliefs about education are difficult if not impossible to change (Pajares, 1992). We disagree. However, the nature of the change depends very much on the content and nature of the influences a teacher undergoes (Beijaard & De Vries, 1997; Ertmer & Ottenbreit-Leftwich, 2010; Wright, 1997). Indeed, there is a bi-directional relationship between pedagogical beliefs and technology use (Tondeur, Van Braak, Ertmer, & Ottenbreit-Leftwich, 2017). Therefore, teachers' experiences with technology can become enablers for pedagogical belief change. It is in particular these 'experiences' that we aim to influence by exposing educators to the HCD mindset, methods and process.

The plausibility of our main hypothesis thus critically hinges on the answers to three research questions, each forming a topic of investigation of its own:

Topic 1. How do educators *perceive* a learning design process conceptualised as a HCD process?

Topic 2. How do educators *perceive* HCD-based design tasks?

Topic 3. To what extent do educators *make proper use* of the HCD methods and process?

To investigate these questions we set up an intervention in the form of a MOOC. The course was designed to allow participants to experience a HCD cycle through a hands-on and project-based approach. For that, a variety of quantitative and qualitative data was collected and analysed by inspecting a number of surveys participating teachers filled out, by scrutinising the artefacts they designed and the comments they made in the MOOC forums. Our findings confirm the relevance of HCD for the design of learning. Our study should be relevant for researchers, practitioners and educational institutions who are currently designing frameworks, activities and tools to enhance educators' design skills.

Methodology

The research context: the HANDSON MOOC

A specific Massive Open Online Course (the HANDSON MOOC) is the intervention this study uses. It is an ecologically valid intervention as it covers an issue many teachers struggle with: the inclusion of ICT in education (OECD, 2015) and as it offers a genuine professional development opportunity for educators of all educational levels (Garreta-Domingo, Sloep, Hernández-Leo, & Mor, 2017). The MOOC - implemented under a Lifelong Learning Programme project (<http://www.handsonict.eu/>) - was open and free. Following Goodyear and Carvalho's Activity-Centred Analysis and Design (ACAD) model (Goodyear & Carvalho, 2014; Carvalho & Goodyear, 2017), it has 'set', 'social' and 'epistemic' design dimensions. It was offered twice (Spring and Autumn 2014). This paper focuses on the second edition only.

The *set design* of the MOOC included Canvas as the course platform; it contained the syllabus, the design tasks as well as the discussion forums. The Integrated Learning Design Environment (ILDE) was the design platform. ILDE allows communities of educational designers to co-create and share learning designs both from scratch or by using the templates provided (Hernández-Leo, Asensio-Pérez, Derntl, Pozzi, Chacón-Pérez, Prieto, & Persico, 2018).

The MOOC's *social design* comprised interaction with facilitators and peers in the forums and through weekly synchronous sessions. Since the MOOC was offered in seven languages in parallel, 15 volunteer facilitators addressed the students in their native language. Knowledgeable in online learning but with no formal HCD expertise, their role was to act as process managers for the participants. English was used for instructions and general communications only.

The *epistemic design* was based on the idea of a learning design studio (Mor & Mogilevsky, 2013; Reimer & Douglas, 2003; Winograd, 1990). In such a model, the main activity is the students' continued work on a design challenge, which they research and for which they devise innovative means of addressing it. In our case, participants individually designed an ICT-based learning activity that by the end of the course was intended to be ready for enactment in their own teaching setting. As per the *social designs*, the input from facilitators and peers was an essential element of the course experience and the learning process.

The course design: the design tasks

The epistemic design of the HANDSON MOOC includes 24 learning activities (Figure 1), which jointly mimic a HCD process from user needs analysis, to conceptualising the solution and, then, testing it on each iteration.

Design Studio for ICT-based Learning Activities - HANDSON MOOC (2)

Week 1: Initiate

Learning goals: Get acquainted with LDS and define an initial version of the educational challenge.

A1: Introduction to the Design Studio for ICT-based Learning Activities!
 A2: Set up your Design Studio Journal. It is a tool for you!
 A3: ILDE Account and Dream Bazaar
 A4: Peer-mentoring - your dream!

Week 2: Investigate

Learning goal: Get acquainted and apply HCD methods for user needs analysis. Review educational challenge based on peer feedback.

A5: Get familiar with the persona concept
 A6: Create your own persona
 A7: Analyzing context, factors and concerns
 A8: The objectives of your ICT-based learning activity
 A9: Revisit your dream and update it
 A10: Peer-mentoring - Your personas!

Week 3: Inspire & Ideate

Learning goal: Continue user needs analysis and shaping the learning activity. Start thinking on monitoring the experience.

A11: Define the heuristics for your design project
 A12: Search for existing ICT-based learning activities
 A13: Learn about user scenarios
 A14: Ideate through writing a user scenario
 A15: Peer-mentoring - The objectives

Week 4: Prototype

Learning goal: Translate the results of previous tasks into a prototype and assess it with a user or peer.

A16: Prototype your artifact
 A17: Revisit and update your evaluation heuristics
 A18: Test your prototype
Advanced authoring and implementation
 A19: Consolidate your prototype
 A20: Peer-mentoring - Consolidate your prototype

Week 5: Evaluate & Reflect

Learning goal: Receive peer feedback on the design activity. Reflect on the course.

A21: Publish your learning activity
 A22: Peer-mentoring - Your learning activity
 A23: Your design studio report
 A24: Reflect and share your thoughts!

Figure 1: The HANDSON MOOC's course activities

Aligned with our research hypothesis, we incorporated two widespread methods in the practice of HCD: “personas” and “heuristic evaluation”. Personas is a method that explicitly emphasises the involvement of the human perspective from the beginning of the design lifecycle. We opted for a lightweight version: proto-personas; these reflect the designer's assumptions rather than real users' data. Heuristic evaluation is an inspection method based on a set of rules of thumb. As a method, it exposes participants to the monitoring and evaluation of their designs as early as possible. Figure 2 is an example of how design instructions were provided.



Activity 5. Get familiar with the persona concept

Handson ICT

Oct 10, 2014 at 10:14am

Get familiar with the "personas" concept and start thinking on your own user archetypes.

Are you familiar with "personas"?, have a look at the following links:

- The learning design grid has a brief introduction to Personas in Learning Design: <http://www.id-grid.org/resources/representations-and-languages/personas> .
- The Interaction Design Foundation has a good introduction to Personas: <https://www.interaction-design.org/encyclopedia/personas.html> .
- What personas are and how they work: <http://www.smashingmagazine.com/2014/08/06/a-closer-look-at-personas-part-1/> .

Here are a couple of resources to learn about different "personas":

- Personas in education from the Fluid Design Handbook: <http://wiki.fluidproject.org/display/fluid/Personas> .
- The personas created during the OLDS MOOC: <http://cloudworks.ac.uk/cloudscape/view/2910> .
- At the UOC we have created the 2 personas that represent our students. Watch the video:



A Google mantra: Focus on the user and all else will follow (<http://www.google.com/about/company/philosophy/>). Do the same with your students! Focus on their needs, expectations and limitations when designing their learning experiences.

For this activity share your ideas and thoughts in the forum. Do you see the value of using "personas"? Have you done this before? Join the discussion and let us and your peers know.

Figure 2: Screenshot of the course environment (Canvas). The instructions for A5 provide an example of the lightweight approach used for the design tasks.

For the key design tasks (A3, A6, A7, A8, A11, A14, A23), participants' work was guided through ILDE design templates. Figure 3 shows the template for A6.

Persona Card Template

Edit this LdS View revision history Duplicate this LdS View duplicates

Sharing options... Trash this LdS

Info and Comments (0) Persona Card Template Support Document

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Public link: <https://ilde.upf.edu/handson3/v/> Embed link: `<iframe height="600px" width="` Unpublish this document Save as PDF

Persona Card - Learning Design

Replace this image with your own, to give your persona a face.	Name: Gender: Age: Lives in ... with ... Likes ...
Education and experience	
Role and responsibilities	
Technical skills	
Subject domain skills and knowledge	
Motivation and desires	
Goals and expectations	
Obstacles to their success	
Unique assets	

Figure 3: Screenshot of an ILDE design template. This is the one used for A6.

The analysis: data collection, participants and techniques

Our study is framed in an interpretative research paradigm (Orlikowski & Baroudi, 1991). It is exploratory, focuses on one particular authentic teacher training context (the HANDSON MOOC), and relies mainly on qualitative evidence (Asensio-Pérez et al, 2017). To reveal trends, the research design follows a concurrent, embedded, mixed-methods strategy (Creswell, 2014). All quantitative data was analysed with descriptive statistics using the R software package (version 3.4.2, downloadable from <https://cran.r-project.org/>).

Topic 1 - Perception of the design process: Data collection, participants and analysis techniques

Surveys addressed topic 1: perception of the design process as an HCD process. Several were sent out to participants: one prior to the start of the course ([preMOOC]), five weekly surveys [weekly]), and one at the end of the course ([postMOOC]). Only the questions related to the characteristics of the participants and the epistemic design of the MOOC have been used to inform the present paper.

A total of 380 educators filled in the [preMOOC]. 66% were female and 34% male. Although participants came from all over the world, three countries represent more than 55% of them: 27% from Spain, 14% from Greece and 13% from Bulgaria. 28% reported to have a bachelor's degree, 52% a master's, and 12%

a PhD. All participants were teaching at the time of the course. The number of years they had been teaching ranged between 0 and 50, with a mean of 13.9 (std. dev. 9.46). The educational level they were teaching at (more than one option was possible) was as follows: 34% higher education, 33% secondary education, 21% adult education, 21% primary education, 16% teacher training and 12% vocational education.

A total of 83 educators filled in the [postMOOC] survey. 80% were female and 20% male. Although again participants came from all over the world, three countries represent more than 74% of the respondents: 28% from Bulgaria, 24% from Spain and 22% from Greece. 10% declared they had a bachelor's degree, 63% a master's, and 5% a PhD. The number of years they had been teaching ranged between 0 and 35; mean 15.6 (std. dev. 8.69). 44% taught secondary teaching, 30% higher education, 23% primary education, 17% teacher training, 15% adult and 7% vocational education (more than one option possible).

Topic 2 - Perception of HCD-based design tasks: Data collection, participants and analysis

The same data sources ([preMOOC], [postMOOC], [weekly]) were also used to answer the question under topic 2: perception of HCD-based design tasks.

Week 2 included two persona-related activities. Their analysis is based on the answer to the [weekly] question "Will you use the persona concept again?" and on an open text field, where participants could answer the question "How do you think you might use the personas concept in your work?". The 48 comments left by participants were analyzed and classified according to categories that emerged from content analysis.

Topic 3 - Use of HCD: Data collection, participants and analysis

The participating educators that formed the Catalan group informed topic 3: proper use of HCD. We restrict our analysis to them as only this group had the option to complete the HANDSON MOOC and provide evidence afterwards on the enactment of the designed ICT-based learning activity in their classrooms. Pursuing both activities gave them Personal Education points (PE Points) officially recognised by the Catalan Department of Education. We only studied cases for which we could analyse the complete experience (Table 1).

Table 1: Data extracted from the Catalan group of participants only. Participants used Catalan in their designs, comments and evidences. Quotes have been translated to English by the principal researcher.

Data source	Description
ILDE designs	The artefacts created through ILDE templates.
Comments on forums	The comments participants made in the forums.
Enactment evidences	Participants had to enact the activity in their classrooms and provide evidences of the experience which also included reflections on the experience.

Surveys	Pre and post MOOC surveys
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For the analysis of these individual experiences, each user (Table 2) was analysed independently but similarly. For each, the available data was consolidated in a single document. We carried out an expert review of their artefacts and took into account their survey responses. The resulting analysis has a narrative format (long and short description; see data statement to access these documents) and then a list of key points which summarise each individual experience.

Table 2: Summary of the characteristics of the six Catalan participants. Participant names are fictitious.

Name	Gender	Highest degree	Educational level	Modality of teaching	Years of teaching
Jordi	Male	Master	Secondary education	Face to face	5
Anna	Female	Master	Primary education	Face to face with some support of ICT tools	6
Maria	Female	Master	Primary education	Face to face	9
Sergi	Male	Bachelor's	Vocational education	eLearning (through online environments only)	1 as an online teacher and 8 teaching in face to face settings
Bruna	Female	Master	Secondary education	Face to face with some support of ICT tools	12
Alba	Female	Bachelor's	Primary education	Face to face	1

Results

Topic 1: Perception of the design process

Participants reported that they joined the MOOC in order to learn about ICT tools for teaching and learning (85% of the respondents to the [preMOOC]). They listed Learning Design second (74%). At the end of the course, participants very much agreed that the course helped them meet these goals. To the question “How useful was the MOOC to learn about ICT tools”, 90% of respondents answered “useful” or “very useful”. A similar degree of agreement was reported on the usefulness of the course “to learn about the Learning Design Studio” (LDS) (91% for “useful” or “very useful”).

At the start of the course, a high percentage of participants declared themselves to have a novice understanding and knowledge of Learning Design (53% were novice or almost novice, 26% neither

novice nor expert, 18% almost experts and 3% experts) [preMOOC]. The level of comfort with LDS increased throughout the course, from 47% in week 1 to 84% in week 5 (Figure 4). Given the [preMOOC] responses on knowledge of LDS and that at the end 60% agreed with the statement “I had never heard of LDS before” ([postMOOC], Figure 5), we consider these results to indicate that the comfort level did indeed increase.

How comfortable do you feel with the Learning Design Studio approach?

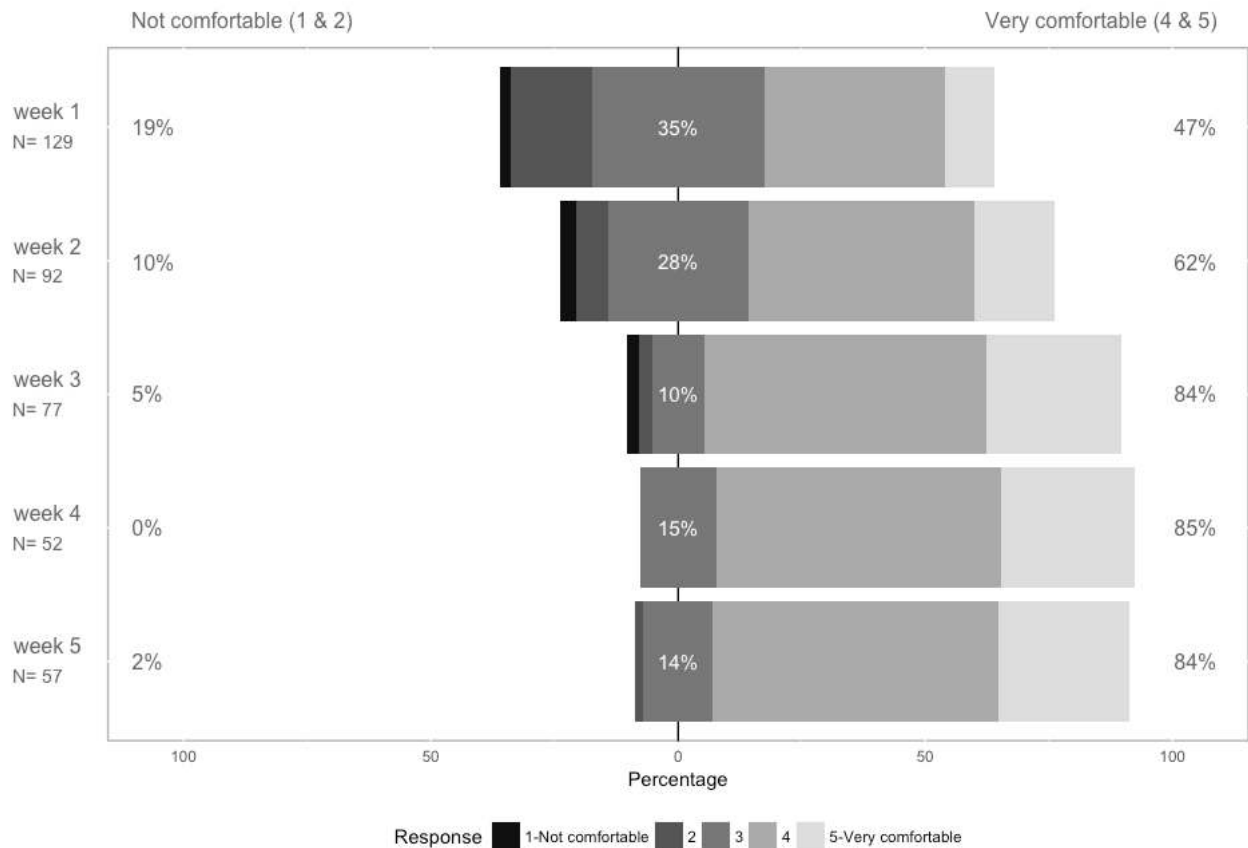


Figure 4: Participants answers to the question “How comfortable do you feel with: Learning Design Studio approach” in the weekly surveys.

Analysing in more detail the participants’ perceptions of the Learning Design Studio (Figure 5), LDS was perceived by them as a relevant resource to include ICT in education and a useful methodology to design learning activities [postMOOC].

Estimate your agreement with the following statements about Learning Design Studio (LDS):

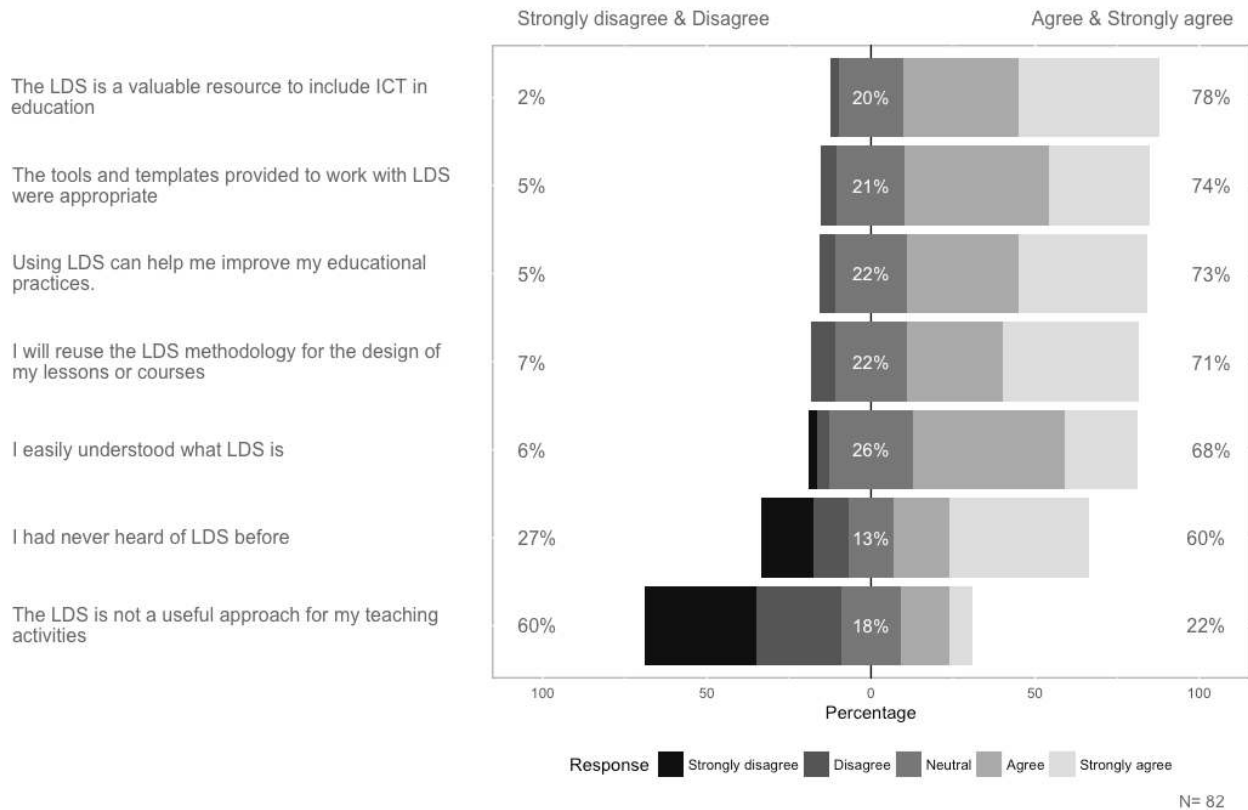


Figure 5: Level of agreement with the statements related to learning design [postMOOC]

The high level of satisfaction with the MOOC (81% gave it a grade of 8 or higher) is in line with the 90% of participants that would recommend the HANDSON MOOC to a colleague/peer and the 95% that would be interested in a new edition of the course (all [postMOOC] questions).

Topic 2: Perception on HCD-based design tasks

For topic 2, we analysed the answers to [weekly] and [postMOOC] surveys. The course aim was that participants end with a ready-to-implement ICT-based learning activity. In the final week survey, 80% of the respondents said they had the intention to enact the activity and 20% said “no” or “not yet” [weekly].

As the course developed, the feedback on the activities progressively became more positive (Figure 5), with week 4 (Prototype) as the one most positively rated. Note, however, that the number of participants decreased as the course went on and that, most probably, only the ones that felt more comfortable with the overall approach and activities continued.

Rate this week's activities:

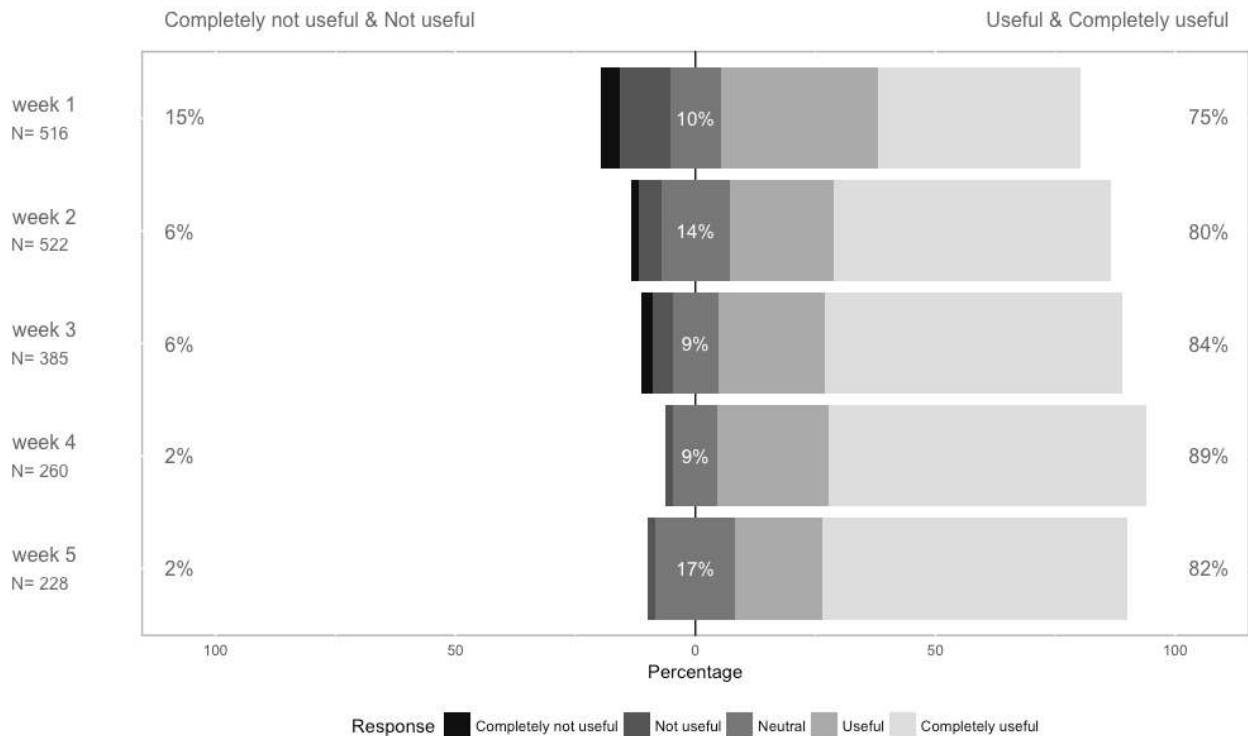


Figure 6: Aggregated ratings for each week's activities [weekly]. N corresponds to the addition of answers for all week's activities.

Participants' perceptions of the value of the design tasks fluctuated throughout the course (Figure 7). Both "prototype your artefact" (A16) and "revisit and update your evaluation heuristics" (A17) were the most valued parts of the course. They were followed by "test your prototype" (A18), "consolidate your prototype" (A19), and "peer-mentoring: consolidate your prototype" (A20). At the same level is a week 2 activity: "get familiar with the persona concept" (A5).

Week 1 featured the activities with more negative ratings. The least valued was "peer-mentoring: your dream" (A4), which was hindered by technical issues and the different paces at which participants completed their activities. Again, in week 3, we saw two more activities with very low scores (completely not useful & not useful): "define the heuristics for your design project" (A11) and "search for existing ICT-based learning activities" (A12). The latter, however, also got very high scores (useful & completely useful).

Rate the following activities:

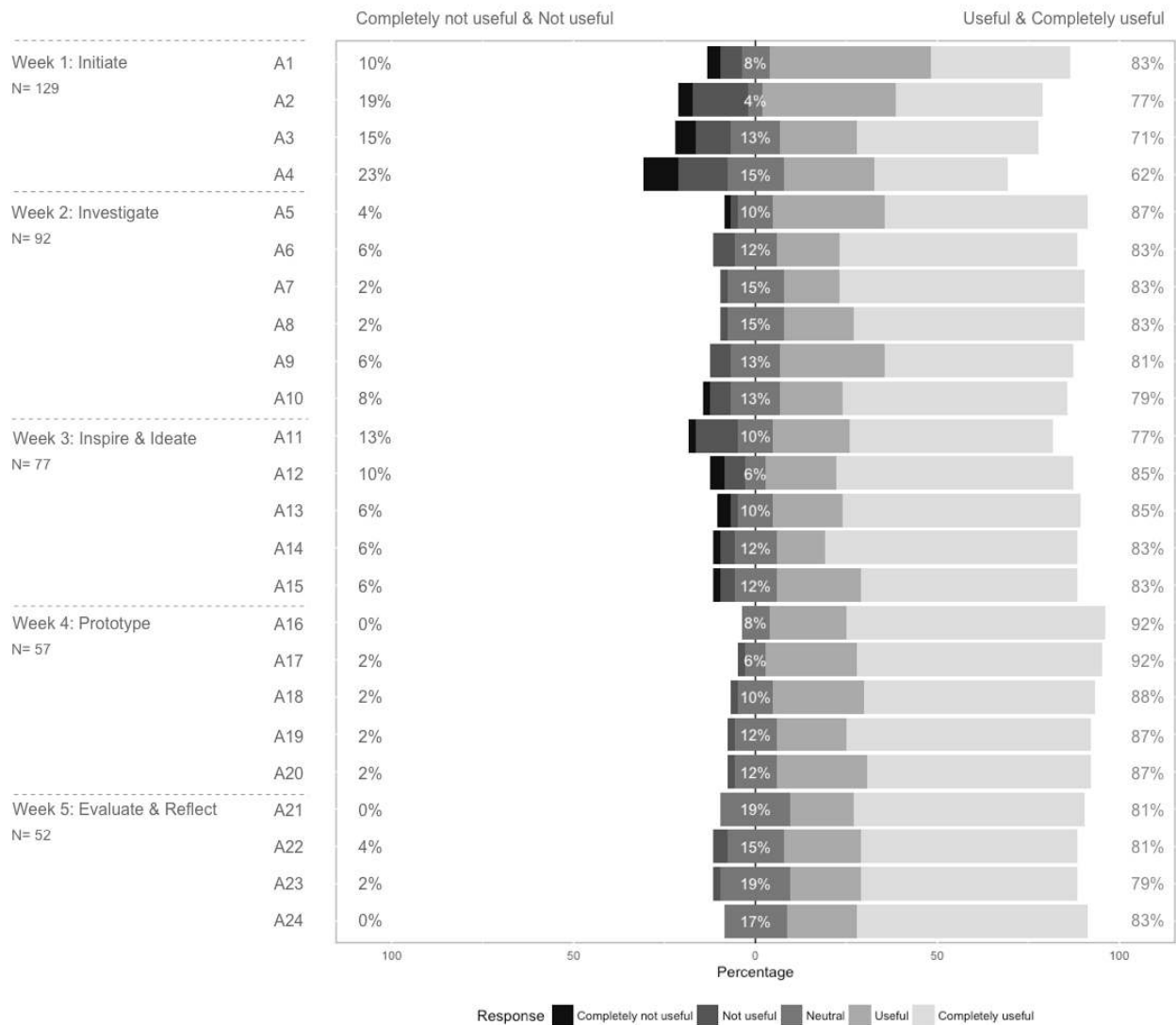
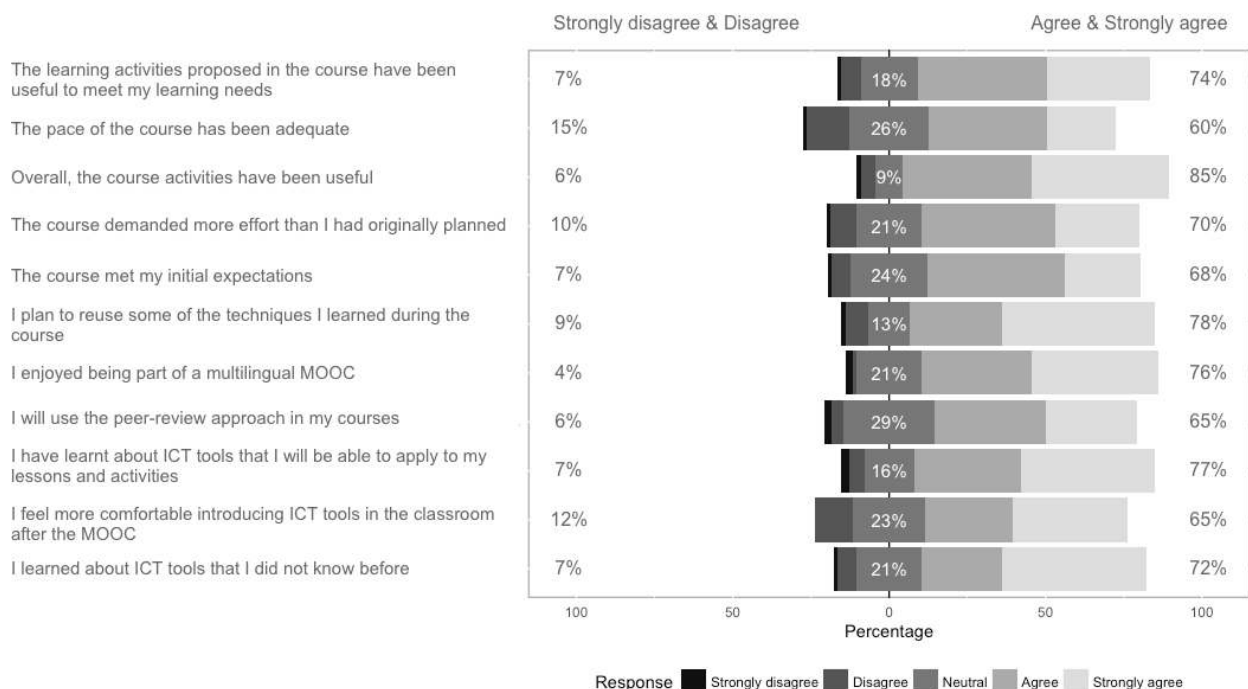


Figure 7: Participants’ ratings to each design task of the MOOC

Despite these fluctuations, the overall feedback on the epistemic design of the course was positive (Figure 8). Most participants reported that they planned to reuse some of the techniques learned during the course. However, they also considered the course’s pace too slow.

Estimate your agreement with the following statements:



N= 82

Figure 8: Participants’ responses to epistemic design statements [postMOOC].

Looking more closely at the personas method, 66% of the respondents said that they would “probably” or “definitely” use the personas concept again; 27% said “maybe” and 7% ticked off “probably” or “definitely not” [weekly]. 48 of the 92 respondents also left comments. Table 3 shows the categories that emerged from their analysis and the number of participants for each category.

Table 3: Categorization of the comments left by participants, a sample comment and the number of participants for each category.

Category	Example	Number of participants
Might use the concept again but unclear how	“Whenever I have to create a project of ICT based learning”, “Will try to assume solutions in everyday teaching problems and plan my objectives and actions according to the concept of the personas”	21
Equals the concept of “persona” to an individual student	“In identifying each of my students”, “To know about the needs and requirements of my students personas will be very helpful. I can base my teaching on it to fulfil the needs of my students.”	16
Will not use the concept again	“Now I have no idea”, “I will not use it”	6

Will use it as “personas” are used	“To clearly define the target group of my online trainings”, “When creating scenarios and templates of SCORM-based eLearning courses”	3
The concept is seen as something they already do	“I think teachers with a long teaching experience have been making use of personas although we have been unaware of it. We used to name our “personas” “kind of students” and to my poor opinion this is how we 'll keep on using the personas concept.”	3

Topic 3: Proper use of HCD from individual experiences

Topic 3 focuses on the proper use of HCD. We analysed the artefacts and other evidence created by six of the participants from the Catalan group. Their experiences clarified to us how each one of them resolved the design tasks and later implemented their ICT-based learning activity in their classrooms. Table 4 presents a summary of each of these experiences.

When reading Table 4, it helps to know that the participants experienced their participation differently. Bruna, Anna and Maria had more formal training in education and technology and also more teaching experience (Table 2). These teachers started the MOOC with a high focus on the ICT tool as their design challenge. Their concern was not how to solve an educational challenge but how to find the right tool to implement the activity they had in mind.

In contrast, Sergi and Alba and, to a lesser extent, Jordi, got most value from the MOOC and the implementation of the designed activity. These three teachers had less prior knowledge in educational methodologies and pedagogy. Sergi and Alba also had less teaching experience (Table 2). The three started with an ill-defined educational challenge and iteratively made it more concrete through the different design activities. The value they got from the course is nicely described in these sentences from Alba:

“Now that I have finished the course, I have to say that looking backwards I have learned much more than what I expected. It is clear now this new way of designing and doing. Relevant concepts such as rethinking the contextualisation through the personas technique and the peer-review approaches have been very interesting to me. Regarding the ICT tools, the course has shown the need to use them in the classroom.”

Table 4: Summary of each of the six Catalan individual experiences and key representative verbatims.

Participant name	Summary of his/her experience	Representative verbatim
Bruna	<ul style="list-style-type: none"> • Educational challenge centered around her needs. • Focus on which design tools to use to 	“‘Learning Design’ is similar to what I do in the sense that I prepare all materials to run the classes.

	<p>provide students with a better experience.</p> <ul style="list-style-type: none"> ● Neutral in most of her survey responses. ● Does several revisions to most of the templates. ● Interest in the creative part of the design process. ● Heuristics as the list of tasks that the students have to accomplish and evaluation rubric. 	<p>What seems more interesting is the idea to use the correct tools to design the learning and reach, through a special or creative way, the “user”, who, in this case, are students.”</p>
Anna	<ul style="list-style-type: none"> ● Focussed on increasing her knowledge of ICTs tools. ● Concerned about her teacher individual needs / her current educational challenges. ● She’s new to LDS and finds it similar to a project-based methodology. ● She does not design an ICT-mediated learning activity, the focus of her activity is that students acquire digital skills. ● <i>She seems to have re-used her activity from a previous design activity.</i> ● Does not plan to reuse the techniques. ● Heuristics as the set of tasks that the students had to do to accomplish the activity. 	<p>“Everything indicates that in a near future, and at a high percentage, learning will be based on mobile devices, both outside and inside the classroom. The increase of number of sales of these devices is considerable. For this reason, my challenge is to use these devices to teach and learn English.”</p>
Maria	<ul style="list-style-type: none"> ● Personal Education points (PE points) is a main driver. ● Novice to LDS but sensible towards what it means, she considers it a valuable approach. ● Has a solution and not a user problem. She wants her students to create a PLE and her problem is to find the right tool. It’s an educational challenge from her perspective. ● Heuristics very close to real heuristics. 	<p>“It’s the first time I see these two words together [Learning Design] but after having read the introduction, I guess that more than once I’ve worked with this perspective. And I do really think that it can help us change things. [...] That there is a design of activities thought by an educator X for a group of students Y is a fundamental premise to make teaching and learning processes work. We have to move from reproducing to producing.”</p>
Jordi	<ul style="list-style-type: none"> ● Educational challenge refined during the MOOC; thus, iteratively becoming more user-centered. 	<p>“I find it essential for any educator to design the learning experience, from scratch, thinking in the types</p>

	<ul style="list-style-type: none"> ● PE points are a key driver. ● Familiarity / sensibility towards the idea of “learning design”. ● Valued the process but not the techniques. ● Did not understand heuristics. 	of students we each have, and up until the evaluation of the activity, while also introducing ICT tools. It is a skill that we all have to work on, sooner or later.”
Sergi	<ul style="list-style-type: none"> ● PE points are important. ● Works on his artefacts iteratively, making revisions on most of the templates. ● He looks forward to the feedback from the course peers. ● Very concerned on how to make his students learn about how to become good professionals (to know how to be, behave and live together). ● Heuristics as evaluation rubric. 	“I am looking forward to see the dreams of my colleagues and be able to comment them with them... I think that their comments will be very enriching for my professional practice.”
Alba	<ul style="list-style-type: none"> ● User with experience in non-formal education. Has been a formal teacher just for 1 year. ● She starts with a real education challenge but with no clear pointers. ● Very reflective artefacts. ● Very student-centered. ● Interested in including ICT tools to adapt learning to her students, increase motivation and keep schools updated with society. ● Heuristics as an evaluation rubric. 	“In the beginning I did not have a clear idea of how to make use of this course and my dream was loosely defined. [...] I think that this process of redefining and rethinking is completely necessary when doing any kind of design... we need to show an open attitude to improve them [the designs]”.

Discussion & Implications for Learning Design

The HANDSON MOOC was a design intervention that guided participants through the design of an ICT-based learning activity of their own making. Modeled as a learning design studio, the course aimed to provide educators with the experience of a HCD cycle and a subset of its methods. We discuss next the key findings related to our three topics.

Topic 1. How did educators perceive a learning design process conceptualised as a HCD process?

In the educators’ opinion, prototyping was the most satisfactory week (week 4); it let them work directly on the design of their learning activity. This feeling of satisfaction ties in with the course’s alleged slow pace: the ability to directly and ‘finally’ work on a solution may well explain the week’s popularity. So

educators seem to have singled out one step only out of an entire HCD cycle; they apparently did not perceive the previous activities as part of defining the solution.

We surmise that the intervention's pedagogical design did not provide enough context for how and why HCD is a relevant framework. Our focus on a practice-oriented approach - albeit aligned with what is known of educators as designers - should perhaps have included more onboarding to HCD. This could be done, for example, by prompting participants to think of good and bad designs; by asking them to suggest the steps involved in a good design process; or by showcasing the design process of well-known and well-designed products or services. After all, examples are an important strategy to facilitate both teacher knowledge and belief change (Ertmer & Ottenbreit-Leftwich, 2010). Nevertheless, even if the participants did not consciously capture the essence of an HCD approach, their effective appreciation of using it was high.

Topic 2. How did educators perceive HCD-based design tasks?

Results show how the intervention yielded a positive experience for its participants, one that in their view deserved to be repeated and recommended to their colleagues. Participating educators proved to have no trouble accomplishing the course design tasks. This was the case even if their perceptions of these tasks varied, presumably depending on how closely they could align them with their own realities. This is very well exemplified by the way they dealt with the "proto-personas" and the "heuristics" activities, both very common in HCD practice.

Participants were positive towards the two personas activities. However, they just seemed to have interpreted it as a description of one of their students as opposed to creating an archetypical student to represent a bigger group, as is the concept's intended use. In contrast, participants did see the heuristic evaluation task as challenging (see also Garreta-Doming, Hernández-Leo & Sloep, 2018), probably since it was hard for them to relate it to something they already knew. Note however how the qualitative analysis of the Catalan educators' activities reveals a similar "assimilation" pattern: instead of defining a set of rules of thumb, some developed an evaluation form via the definition of rubrics.

Topic 3. To what extent do educators make proper use of HCD methods and process?

The analysis of the six individual experiences shows conflicting results regarding proper usage. On the one hand, participants with less formal training in education frameworks got the most out of the intervention. These "less knowledgeable" educators understood both the design process and how each design task fitted in it. They started with an educational challenge and iteratively defined a learning activity to address this challenge. On the other hand, participants with more knowledge of pedagogical approaches had a stronger focus on ICT tools, biased by their earlier experiences and knowledge, and they benefitted less from the HCD approach and techniques.

We can interpret these last findings in the light of how teachers' beliefs either hinder or facilitate technology use (Tondeur et al., 2017). Beliefs influence knowledge acquisition, interpretation of course content, and comprehension monitoring (Pajares, 1992). As a result, previous knowledge and experiences seem to have prevented our more pedagogically knowledgeable participants from adopting a HCD

mindset. On the other hand, “less knowledgeable” participants followed and benefited from the guidance provided in the course. Both Pajares (1992) and Wright (1997) discuss the pervasiveness of educational beliefs of preservice teachers; this notwithstanding, our results lend support to the inclusion of HCD in teacher training as early as possible, that is before prejudice or ill-founded beliefs have taken hold of student-teachers.

Does our intervention show that it makes sense to use HCD as a source of guidance for improving the design practices of teachers? Is HCD practice transferable to the design practices of educators? With some reservations, we would want to answer these questions affirmatively. The results under topic 1 and 2 about the teachers’ overall positive perceptions of the MOOC intervention warrant this, as does the analysis of the narratives of the novice teachers under topic 3. So the practice-oriented, hands-on and empirical approach of HCD can indeed create the experiences needed to (re)shape educators’ design beliefs. Put differently, HCD can occupy the “middle ground territory” between philosophy and pedagogical tactics (Goodyear, 2005) which is often complex and demanding in terms of design.

However, our results under topic 3 of the more experienced teachers point out that HCD practice needs to be contextually tweaked prior to its transfer, lest its use is misunderstood. Although the evidence is suggestive rather than definitive, we also conclude that educators should be repeatedly and iteratively exposed to HCD. Pedagogical beliefs tend to be persistent and formed by past experiences, thus, long-term (and embedded) professional development is needed in order to change teachers’ pedagogical beliefs and practices (Tondeur et al., 2017). The willingness of the participants to repeat and recommend our one instance should be leveraged by researchers, practitioners or institutions willing to put in place HCD for the design of learning activities. So even though the balance is tipped in favour of the inclusion of the HCD philosophy in the design of learning, more research with more finely tuned interventions is needed to reap all of its benefits.

Acknowledgements

We gratefully acknowledge the help of the HANDSON Consortium partners. Special thanks go to Alberto González Mosquera for his help preparing the figures. This work has been partially supported RecerCaixa CoT, MDM-2015-0502, TIN2014-53199-C3-3-R, TIN2017-85179-C3-3-R.

Statements of open data, ethics and conflict of interest

The datasets used to underpin this paper (survey results, individual case description and data) are available in Zenodo as open data (<https://doi.org/10.5281/zenodo.1181955>).

The present paper describes one of the several interventions that were conducted as part of the HANDSON project (<http://www.handsonict.eu>), which was funded by the EU’s Lifelong Learning Programme (https://web.archive.org/web/20130726030319/http://ec.europa.eu/education/lifelong-learning-programme/doc78_en.htm). The contributions the various consortium partners made to the project were all covered by their institutional regulations regarding ethical research conduct. This meant that, prior to their enrolment, participating teachers were asked to agree with the harvesting and possible

publication of their data and metadata, with the stipulation that it was used for research purposes only and under the guarantee of anonymity.

The authors have no conflicts of interest to report.

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