

# Learning Through Making – Using Research Through Design as a Pedagogical Approach

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## Abstract

Research Through Design (RtD) has recently grown as a perspective in the fields of HCI – Human Computer Interaction and interaction design research. With a focus on *making and doing* as a way of *exploring* RtD has successfully established a link between making and reflecting. However, from the viewpoint of learning there is still a lack of literature describing how the RtD approach can be useful in pedagogical settings, e.g. as an approach to learning and as a method for interaction design students. To address this need this paper describes a Learning through Making (LtM) approach to interaction design. We suggest that a Learning through Making (LtM) approach can be grounded on earlier work on Research through Design (RtD) and we present the setup of a new student lab in our department explicitly aimed at supporting this proposed approach before concluding this paper.

## Introduction

Research Through Design (RtD) is an approach that has its focus on doing as a way of exploring and to generate new knowledge. Over the last couple of years RtD has grown as a perspective in the field of Interaction Design and HCI (Human Computer Interaction), see e.g. Dalsgaard, P. (2010); Zimmerman, et. al (2010); Gaver (2012); Bardzell, et. al. (2015) and today it represents an established way of conducting research in our field.

Yet, Research through Design is just one of many approaches taken today towards interaction design research. There is a growing body of research on craft-based, and material-centered approaches to design (see e.g. Wiberg & Robles (2010); Wiberg, et. al., 2013 and Wiberg (2014)), with roots going back to the early work by Donald Schön (1984) and the Research through Design approach can further on, and in more general terms be seen as a way of aligning the interaction design research agenda with the current maker and DIY movements in our field (see Lindtner, et. al., 2014).

Besides the historical connections we should also notice how the Research through Design approach belongs to a contemporary orientation towards craft-based methods to interaction design. However, and from the viewpoint of learning, and in particular when it comes to educating interaction design students, there is still a lack of literature describing how a Research through Design approach can be useful in pedagogical settings, e.g. as an approach to learning and as a method for learning interaction design.

To address this need this paper proposes and describes a Learning through Making (LtM) approach to teaching and learning interaction design. We suggest that a Learning through Making (LtM) approach can be grounded on earlier work on Research through Design (RtD) and we present the setup of a new student lab in our department explicitly aimed at supporting this approach. We then present our reflections on how this enable not only new pedagogical approaches to interaction design, but how it also enables our students to combine making and reflecting as important factor of their learning processes before concluding this paper.

## **Background and related work**

There is a growing body of research focused on Research through Design approaches to interaction design, see e.g. Gaver (2012); Zimmerman, et. al (2010); Bardzell, et. al. (2015). Typically, RtD concerns ways of using design as an approach to explore alternative futures, to explore new use scenarios, or as a way of exploring the potential of a certain technology for a particular setting or social context.

Related to this stream of research there is an ongoing debate focusing on what RtD can offer, its advantages and its drawbacks, and its theoretical underpinnings. For instance, Gaver (2012) acknowledges what we can expect from the Research through Design approach while Zimmerman, et. al (2010) provides an analysis and critique of RtD as an approach to interaction design research. Theory wise Bardzell, et. al. (2015) goes into details of the theoretical underpinnings of RtD and they illustrate how RtD can be used to not only move forward with a design approach, but how this approach can also generate new knowledge.

From the viewpoint of learning, and e-learning in particular, there is a growing interest in ways of combining information technology with traditional classrooms (Wiberg, 2007). This strand of research is typically referred to in terms of “mixed” classrooms, but there are also lots of initiatives taken at the current moment to combine information technology with the physical classroom under the umbrella notion of “studio-based learning” (see for instance Carter & Hundhausen (2011) and Hundhausen, et. al. (2011)).

Still, there is a lack to approaches taken to unite the current DIY/maker movement with the design of physical learning environments as to enable a “student as maker” approach to interaction design. To address this need this paper reports from our ongoing efforts made to establish one such “maker space” for our interaction design students. Further on, this paper says a few words about not only what that gives the students in terms of equipment, but also what it might mean for them and their learning processes.

## **Establishing a space for students as makers – from computer lab to maker space**

In this section we describe how we have been inspired by our ideas of a Learning through Making (LtM) approach to learn interaction design, and what it has meant for the design and implementation of a new student lab in our department. In short, and from our perspective the Learning through Making (LtM) approach is not just an idea we have for how the RtD approach to interaction design research might be possible to transfer into educational settings. Instead, and to us, it has been a practical and guiding

concept for how we have thought about and implemented a new lab environment for our interaction design students.

Basically, our new HCI/interaction design lab is all about Learning through Making. To make this new space for learning a reality we have reconfigured a traditional computer lab into an environment intended to support, not just collaboration between students, but also *creative making, prototyping* and *experimentation* with technology.

One important driver behind the design and implementation of this maker space for our students was that we wanted to create a space where our students could actually play around with the technology, and not just hear about it from a professor. For instance, nowadays there is a lot of talk about 3D printers and how 3D printing might change the whole manufacturing industry. One such movement in society is not just something we want our students to be aware of (e.g. told about in a lecture), but we want our students to actually be good at using and exploring what one such technologies could support and enable. In short, by experimenting and actually trying the technology it might not just enable our students to *design* things, but also to *learn* about the technology in a different way, and accordingly get a different *understanding* of the technology.

To make this happen we have equipped our new lab with lots of technology that taken together forms an interaction technology workshop environment which the ordinary interaction design student might not have access to in other forms. This includes a setup with 3D-printers, a laser cutter, 3D software and powerful computers to work with and render 3D and animations. The lab also provides technology for working with “physical computing”, e.g. for exploring tangible interaction solutions including e.g. arduino boards, sensors, actuators, raspberry PIs etc. Figure 1 below illustrates both some of the technologies available in the lab for our students to play around with (left) and one of our 3D-printers in action in a session with one of our teachers (right).



Figure 1. Two pictures illustrating some equipment available in the new lab including arduino boards and sensors (left) and 3D software and 3D printers (right).

## **Students as makers - A new pedagogical approach**

Learning through Making (LtM) is not only about technical equipment and about arranging a physical so that students can experiment with the technology. More fundamentally it is also about finding new ways for teaching and learning in relation to this new physical space and the equipment made accessible to the students. Accordingly, this section is spent on describing our lessons learnt so far when it comes to using this new space during last semester in support of interaction design students as “makers”. Below we describe both ongoing work related to course development following the “Learning through making” idea, and also our experiences so far from working with our students in this environment.

So, in a course we are currently developing we are working with the idea of “prototyping interaction”. Basically, the idea is that interaction design is hard to do theoretically, to first come up with an idea and then just implement this idea and at the same time get it right. As a slightly alternative approach our idea of “prototyping interaction” builds on the idea of encouraging the students to “think a little, and do a little”, i.e. to approach interaction design as a “learning through making” process. In more particular words, and in relation to this particular course that is for the students to generate an idea, formulate it and then go and test it, refine the idea and then experiment some more. As such, “prototyping interaction” becomes an iterative process that constantly shifts between reflecting and doing, doing and reflecting.

Through this process we have noticed that our students have started to view themselves slightly different. We would not say that our students have abandoned an understanding of themselves as “learners”, but they have for sure complemented this image with an understanding of themselves as “makers”. In short, we believe that they have drifted in their understanding of themselves toward something which would align closely with Schön's notion of a “reflective designer”, or in this case, the student as a “reflective learner”.

### **Discussion**

There are of course many aspects of this ongoing work, and we are of course only in the beginning of a change project defined not only in terms of the re-configuration of a learning space, but more fundamentally about the re-configuration of a learning process and learning context. Still, at this early moments of our project we can already see several positive outcomes from these first steps taken.

First of all, we should acknowledge have a “Learning through Making” approach of interaction design studies do enable a design-oriented approach to interaction design. Basically because design and hand-on experimentations becomes a focal part of the learning approach taken in relation to interactive technologies.

Secondly, we can already see how our students, already after only one semester in this new environment, have gained a different understanding of the technology, its potential, its inner logics and its limitations when explored via the hands of the learner. In short,

the hands-on explorations of the technology do not only support creative making, but also a more direct understanding of the interactive materials at hand.

And finally, we have noticed that our students have started to ask different kinds of questions when they get to explore technology in a more “hands-on” manner. We have during this semester seen many examples of how a Learning through Making (LtM) approach to interaction design do bring the students and the technology as a design material closer together.

## **Conclusions**

In this paper we have presented a Learning through Making (LtM) approach to learning interaction design. Our proposed LtM approach has been motivated by the establishment of Research through Design (RtD) as a solid approach to interaction design research over the last few years. By introducing LtM we have in this paper demonstrated how the basic building blocks behind RtD is also valid not only as a research approach, but also for learning purposes. In this paper we have described how LtM not only establishes a link between making and learning, but how this approach also follows a long-term tradition in our field focused on making and reflections. Finally, and in order to illustrate how learning environments can be configured to support this kind of approach we have exemplified our approach with a description of a new student lab in our department explicitly designed to support experimentation, prototyping and maker approaches to interaction design.

## **References**

Bardzell, J., Bardzell, S., Koefoed Hansen, L. (2015) Immodest Proposals: Research Through Design and Knowledge, CHI '15: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems.

Carter, A., Hundhausen, C. (2011) A review of studio-based learning in computer science, Journal of Computing Sciences in Colleges, Volume 27 Issue 1.

Dalsgaard, P. (2010) Research in and through design: an interaction design research approach, OZCHI '10: Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction.

Gaver, W. (2012) What should we expect from research through design?, CHI '12: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ACM.

Hundhausen, C., Fairbrother, D., Petre, M. (2011) The "prototype walkthrough": a studio-based learning activity for human-computer interaction courses, ICER '11: Proceedings of the seventh international workshop on Computing education research.

Lindtner, S., Hertz, G., Dourish, P. (2014) Emerging sites of HCI innovation: hackerspaces, hardware startups & incubators, CHI '14: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ACM.

Schön, D. (1984) *The Reflective Practitioner: How Professionals Think In Action*, Basic books.

Zimmerman, J., Stolterman, E., Forlizzi, J. (2010) An analysis and critique of Research through Design: towards a formalization of a research approach, DIS '10: Proceedings of the 8th ACM Conference on Designing Interactive Systems.

Wiberg, M. (2007) Netlearning and Learning through Networks, JETS – the international Journal of Educational Technologies and Society, issue “Current Approaches to Network-Based Learning in Scandinavia”, 10 (4), 49-61.

Wiberg, M., Ishii, H., Rosner, D., Vallgård, A., Dourish, P., Sundström, P., Kerridge, T., Rolston, M. (2013) Materiality Matters – Experience Materials, ACM Interactions, March+April 2013.

Wiberg, M. & Robles, E., (2010). Computational Compositions: Aesthetics, Materials, and interaction design. *International Journal of Design*, 4(2), 65 – 76.

Wiberg, M. (2014) Methodology for Materiality: interaction design research through a material lens, *Personal and Ubiquitous Computing*, Springer-Verlag, UK, 18(3): 625-636.