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Design Transformations

teaching design through evaluations

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Published in:
Kybernetes

DOI (link to publication from Publisher):
[10.1108/K-07-2014-0153](https://doi.org/10.1108/K-07-2014-0153)

Publication date:
2014

Document Version
Early version, also known as pre-print

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Morrison, A., & Knoche, H. (2014). Design Transformations: teaching design through evaluations. *Kybernetes*, 43(9/10), 1372-1380. <https://doi.org/10.1108/K-07-2014-0153>

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Kybernetes

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Article information:

To cite this document:

Ann Morrison Hendrik Knoche , (2014), "Design transformations: teaching design through evaluations", Kybernetes, Vol. 43 Iss 9/10 pp. 1372 - 1380

Permanent link to this document:

<http://dx.doi.org/10.1108/K-07-2014-0153>

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Design transformations: teaching design through evaluations

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Abstract

Purpose – The purpose of this paper is to synchronize two courses to focus on the students working with learning and applying tools in the one course and acting on understandings gained to produce artefacts in the other.

Design/methodology/approach – Working with real users throughout all stages of the design process, the authors structured two courses so findings from the evaluation methods learnt in the one course (their analyses) were directly acted on in the other (their re-designs). The authors fostered a group-spirited learning environment where students presented designs-in-process; explained the findings from focused evaluation methods using tangible representations; identified the relationship from these findings for subsequent re-design rationales; and discussed and critiqued each other's work using multiple feedback, teach-back and discursive strategies.

Findings – The authors found that in-depth coverage of material, working with real data and users at all stages of assessment and producing visualizations from evaluations, naturally forced student motivation to act and redesign better solutions. The authors noted improved attendance and students reported high engagement and content appreciation.

Research limitations/implications – Ensuring relevance, by adding larger context concerns, expansive critical methods and feedback processes in a cycle of understanding, acting, learning can have useful practical and social implications. This is germane when designing for quality of everyday use in, for example, education, urban environments and mobile applications.

Practical implications – The paper includes implications for the development of learning environments where course and semester content is developed in tandem to support integrated learning by acting with project output and teach back "presentations" throughout the course.

Originality/value – The paper proposes a unifying tandem approach to learning and applying evaluation tools with real users, teachback and acting to improve redesigns with potential to improve human computer interaction educational standards for learning and design outcomes.

Keywords Design, Learning environments, Conversation, Evaluation, Tangible

Paper type Case study

Introduction

The design and creation of digital systems that meet people's needs and capabilities requires a large skill set. To address this the transdisciplinary field of human computer interaction (HCI) incorporates knowledge and methods from social and behaviour sciences to understand the context in which users will engage with digital systems, its design and implementation as well as its evaluation.

In this paper, we use an approach to pedagogy through a case study working with two Aalborg University Bachelor level Media technology courses. We focus on instigating practices of acting, learning and understanding – methods worked with at 2013 ASC Annual Conference – and various feedback methods within a design cycle



system to better manage learning outcomes. The main motivator for the pedagogical approaches instigated was to address prior issues where students had misunderstood the relevance of evaluation methods and to ensure students apply the material from evaluation techniques and understanding how people interact with technology from one course, into another course, which focused on designing such technology.

Working deliberately within the circle of acting, learning and understanding, we wanted our students to act as participants – to listen and to converse – not to be receiving delivered knowledge, rather to be exploring their own (and our shared) emergent set of questions. This required a higher order critical reflection and knowledge elicitation (Harri-Augstein and Thomas, 1991).

Related background: learning the tools to transcend language

While design classes generally follow in structure Kolb's (1984) experiential learning cycle the evaluation and understanding of the designed artefacts is often limited since the emphasis is on learning the design process and its tools. Conversely, classes focusing solely on learning formal evaluation methods do not consider how their findings can concretely assist in the creation of novel designs. The outcome here, is that formal evaluation results are seen as methods useful to write up finite results (for publication purposes), but not to be continuously employed throughout all stages of the design cycle to proactively inform insights that come when making the trade-offs and judgments necessary to synthesize a new artefact. This is the linkage we make running these two courses working with the same material with learning and applying both the design tools and the evaluation tools with real users with each method that is taught.

It is commonly understood that design learning is as good as the feedback the student receives on their actions and the forms they have given to content. Harri-Augstein's and Thomas' (1991) propose learning conversation, where the "self-organized learning" emphasizes enabling students to "learn-how-to-learn". As Bernard Scott (2001) summarizes Harri-Augstein and Thomas identify three major components for a full "learning conversation":

- conversation about the how and why of a topic, as in the basic Pask model;
- conversation about the how of learning (for example, discussing study skills and reflecting on experiences as a learner);
- conversation about purposes, the why of learning, where the emphasis is on encouraging personal autonomy and accepting responsibility for one's own learning (Scott, 2001, p. 10).

These self-organized thinking steps are required in order to achieve higher-order critical reflection and knowledge elicitation (Harri-Augstein's and Thomas', 1991). An engagement with feedback – both from self and through others – that takes the student through a hierarchy of full "learning by conversation" process.

To assist this accelerated learning process, we work with Vygotsky's (1978) ideas of the zone of proximal development – defined as the difference between actual and potential levels of development – determined by comparing what a student can achieve alone and what they can achieve with the assistance of an expert other. In the classroom where multiple forms of feedback are enabled as a matter of course and all voices are encouraged, the students get information from many levels of expertise – age range, experience, novice use, first time thinking, to experts in the field. They do not learn alone. In addition, in creating a more informal environment that encourages play, through language use, interactive skits and playful demonstrations (see workshops), we aim to

encourage the separation of thought from actions and objects, mental representation and symbolic function. Working with Vygotsky's (1978) body of work we understand that the pretend situation of play creates an imaginative dimension, where the separation of the meaning from the object promotes the development of abstract ideas and abstract, verbal thinking. In addition, the students gradually learn an expert language from the design and evaluation fields and here language is a tool that opens up new ways of thinking and talking about their design problems.

For the design process and to step up the process of critical reflective self-evaluation students need to develop qualities to be able to judge their own work, harshly if needed. When immersed in design and creative processes or making devices, it can be difficult to step out of a small-problem solving frame of mind – particularly within an educational institution – where autonomy in what problems the students address is not always given. Based on Pask's (1976) work on conversation theory Laurillard (2002) posed a two level model of teacher student interaction. On the higher level the students re-articulate concepts on a theoretical/conceptual level and receives an initial articulation and feedback from the teacher. On the lower level the students also engage in goal oriented behaviour in the experiential micro-world set up and adapted by the teacher. The students can act concretely within this experiential environment and then reflect on to adapt the understanding of the concept.

Implementing and prioritising feedback mechanisms (including feedback from users, classmates, experts and teaching staff) within a scaffolded course structure, ensures students have the possibility to engage at multiple higher levels. For the teaching staff, not teaching in a role of keeper of the knowledge or as a higher authority, rather a role of immersing students (and selves) in discussions – and actions; making and doing makes for a lively and interesting process with models and methods of pedagogy, theories and practice constantly under scrutiny, (re) negotiation and (re) agreement (Scott, 2001).

Research inquiry

We developed two new courses that we ran side-by-side so students could apply material from the first to the second. We wanted to make clear the significance of learning, implementing and applying analyses from evaluation methods work with real participants (and largely in the field as opposed to in laboratory settings) continually throughout the design process in the second course. Making immediate outcomes obvious and useful in follow-up activities seemed a sensible approach – fitting well within an ethnographically informed design cycle and cybernetic theory approach and compatible with our own research styles.

As observer-participants in the teaching environment, and despite our scientific training to be otherwise, we need be reflectively aware of our reflexivity and our predilections. In the courses, this gathering of observational data – video, audio, logging of activity on devices, interviews, etc. – although only as good as the focus – attempts to circumvent, expand out, expose even these *a priori* predilections. Within the academic institutions we – and this we includes to varying degrees, student and teacher – operate within a community of “consensual domains” (Maturana, 1969).

Workshops: theory, action, feedback

We worked with both theory and practice in all half-day sessions. Lectures typically motivated and introduced and contextualized a (theoretical) concept, e.g. a method, including its terminology in spurts of 20-30 minute. Hands on exercise followed in

which students tried to apply their gained (usually partial) understanding of the concept to a concrete artefact that they created in small groups of three to four students. They could then experience said artefacts and reflect through evaluating and/or discussing them with their peers (from their own and other groups) and us to adapt their understanding of the concept. This activity cycle is depicted in Figure 1.

In order to establish a relaxed environment where all voices could be heard and discussions were promoted, as a beginning strategy we allowed extra time for interruptions and discussions in our own presentations, e.g. to accommodate conversations around the why and how of the learning as modelled by Scott (2001) after Harri-Augstein and Thomas' (1991) work on self-organized learning.

For every exercise, we went around to each group spending as much time as needed for questions and to help students to particularize their own content as they directly applied the taught concepts. It was our deliberate intention to work within a systematic process to reinforce the strong correlation between theory, action and feedback (Heinze *et al.*, 2007) with a continuous cycling of switching between these stages throughout the workshop sessions.

To foster peer-learning, improve teachback (cf. Pask, 1975) situations and facilitating communication around the outcomes from exercises we required the students to create and work with physical artefacts not residing in their laptops, e.g. with foam boards for moving stickies and notes around on – small tangible keywords, paper sketches (see Figure 2). The students often relied on the physical artefacts

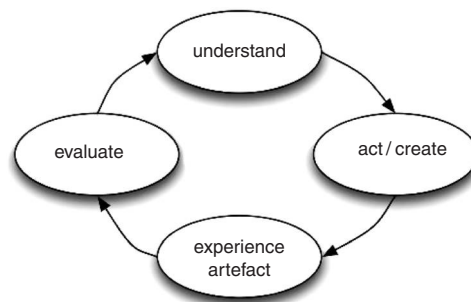


Figure 1.
The activity cycle in
the classes



Figure 2.
Stickies and foam boards
supported making design
decisions visible and made
contextual information
available during peer
exercises such as show
and tells

during many of the exercises to help in the process of negotiating and communicating their understanding.

The students received feedback both from the teacher and their peers in different situations:

- (1) within groups;
- (2) student-to-teacher, whenever we visited the groups, e.g. when they had questions and would explain how they applied the concepts;
- (3) (from student to) teacher to class;
- (4) student-to-student;
- (5) group-to-group; and
- (6) group-to-forum and to teachers.

The students discussed within their group how to apply a new method. If they could not establish a shared consistent interpretation they would ask the teachers for clarifications and re-formulations of the concept. When doing this, the students often relied on teaching back their current understanding to us. If the discussion around their question or detail had benefits for all students, we would halt the class and raise the question for discussion with all. Right after an exercise we often required the students to present their outcomes of applying a method and understanding of it to another peer in one-to-one situations (cf. Scott, 2001) who in return had to give feedback according to their understanding of the presented material and the introduced concept. At times students were asked to work with cross teachback and feedback in double groups together, in which they would explain a design or evaluation or swap artefacts and work first on one groups project-applied-exercise and then on the others (see Figure 3).

During class presentations the students explained and summarized their understanding of the taught concepts to all other students and the teachers. During these teach-back presentations the students in the audience provided written feedback on paper slips to their peers, e.g. by pointing out strengths and weaknesses according to their own understanding of the taught material. The students then had time to reflect on and act on the obtained feedback to rework their artefacts. In doing the one-to-one, group presentations and written and oral feedback to each other, the students were appropriating concepts and terminology from the lectures and discussions and honing and expanding their vocabulary to be able to discuss at large and in detail particularities, broader concepts and their own and others' leaps in understanding.

Findings: students engaged

We found that in-depth coverage of material, working with real contexts, data and users at all stages of assessment and producing visualizations from evaluations, naturally forced student motivation to act and redesign better solutions. Once the students saw patterns emerging in their analyses, they had concrete evidence to work with – often supportive of their own tacit understandings of what might work best. Consequently, they were then energized to investigate by following hunches and ultimately improve their designs and their design understandings. We noted improved attendance and students reported high engagement and content appreciation, marked when compared to previous runs of the separated courses.

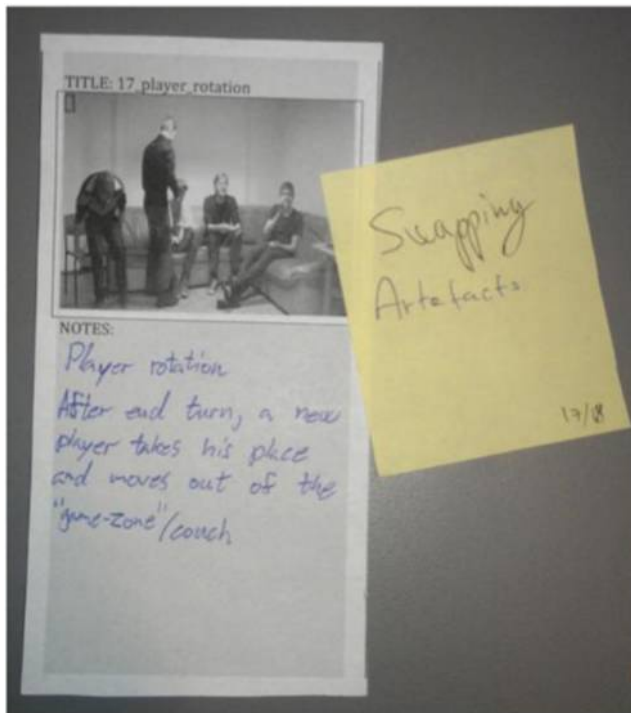


Figure 3.
Physical artefacts
produced and swapped
between teams to enable
consistent referencing and
common understandings

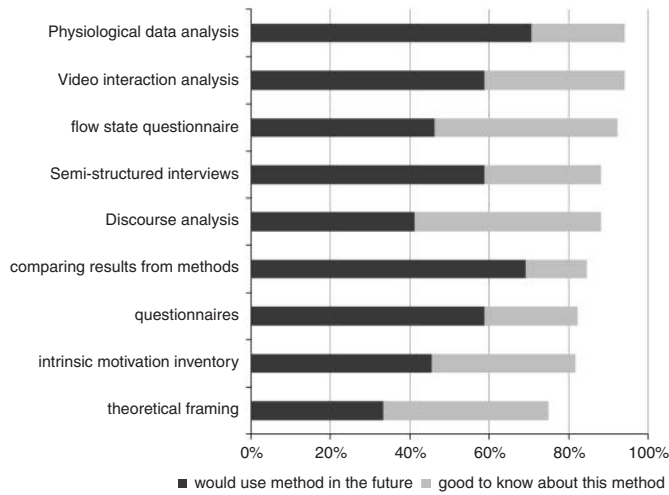
Given the constant feedback to groups, our teams were patient as it took some considerable time to get around the groups – there were 33 students with two teachers and multiple particular questions relating to applying methods to their particular topic.

In addition to our observation mechanisms and continual formative in-class assessments, on a course level we received feedback from the students through different channels. The students have three semester group meetings with the semester coordinator, where they report on progress and/or issues with their project, supervision and courses. We implemented several other feedback mechanisms: an active listening form hand in and an online questionnaire on each course's material (anonymity was enabled for both). Active listening feedback forms asked if there were any questions or comments and ensured any misunderstandings about content, pace, requirements or any other issues from each session were directly addressed at the commencement of the next session. We have found this type of "house-keeping" useful to engage with why and how types of questions around the style of learning we were instigating in an active way and to see which content the students responded to (see Figure 4). For example, respondents were largely in favour of teachback activities and stated that the presentation of findings (88 percent), peer critiquing (74 percent), foam boards (80 percent), joint sessions (70-80 percent) helped them in their work. This supports our classroom observations.

Discussion

Within the design phases we required students to apply the methods taught to their project and share their intermediate outcomes and insights in presentations and

Figure 4.
Students opinions about
course content



peer-critiquing exercises. We encouraged them to leverage the gained understanding in the subsequent design phase, which included a new loop of applying methods to the design object. In each design phase we therefore promoted understanding through acting (applying of and reflecting on methods) and to inform this acting from the evolving understanding of the design problem. The groups had continual feedback throughout the course at each stage of the process, after each new theory, method, activity, analysis and then the following new reimplementation of results into the redesign. There was a constant cycle of theory, action and feedback (Heinze *et al.*, 2007).

Both authors attempted to continually be aware of their own and the others observational predilections with an agreement to observe and report back. We committed to a team teaching process, attending each other's courses and the joint sessions. We constantly monitored, discussed and rearranged scheduling factors to keep the courses content aligned, scaffolded and at the correct pace by adjusting or by adding other elements to assist learning, workload or where material needed more time, etc. In addition, we maintained a tag-team role in the classroom – by our presence – our participation, our interventions, our conversations – both with them as individuals, as smaller groups, with the larger group and between ourselves – requiring they stay there and requiring they keep working with the material and be mindful. We assessed what they understood by how they discussed it and showed what they had learnt (their evaluations) and by what they then made in acting with the understandings gained (their re-designs).

In the transition from lectures to hands-on exercises, we often required the larger class to engage with materials on display (e.g. a video snippet). In doing this, we often added a variety of performance demonstrations or “skits”. For example, to assist with understanding what they would need to look at to perform a thorough analysis, we might perform a series of micro-interactions in front of the class. To that effect we hammed up our skits slightly, adding a comic element to the proceedings, mentioning our own hesitations at appearing as idiots to set up a more informal learning environment. We then asked the students to unpack verbally the kinds of micro-interactions, they had just witnessed. In turn, later when presenting, students

often invited others to also demonstrate and/or participate into their own presentation-demonstrations. In this way, we began a process of entering the students into our language and activity games (Wittgenstein, 1965) with a series of small moves where we required they report on or define the activity they had witnessed, e.g. in this case the micro-interaction might entail pointing into the distance while moving a device or similar. In so doing, we invited them into what Wittgenstein (1965) calls the “Pleasure of Language”, where by revealing enjoyment in “the turning of a phrase” – unpacking the meaning accurately and describing it well and in doing so uncovering the joy of language – where the action is well-described and in a pleasing way. We needed the students to be active and to try things, but not feel as if they were on display or performing while doing so. We wanted to develop an environment that students felt at ease to be playful in. These “language games” as a form of instruction, gradually built over the course sessions into a set of continuing mini-jousts with measured moves and a building “story-line” of language and previous reference points. The students built from these sets of micro-interactions and mini-joust activities to build a repertoire of scenarios to be able to discuss broader issues (Searle, 1964). They build their own meanings based from their own prior experiences and understanding (Von Glasersfeld, 1991), in order to work with and overcome the limits of language in directly transporting complexity. In the classroom, we attempted to enable the students to create new languages (or tools) to transcend these limits, so the students discuss, sketch and visualize ideas and findings through metaphors, diagrams and graphs and again through physical artefacts and re-designs to better express their learning and the complexities they engage with.

Conclusion

The process of continual evaluation, analysis, reflection and redesign using tangible materials and making evidence visible throughout the process, made an impact. Most groups understood the learning that had taken place and responses to our online feedback questionnaire showed surprisingly high assessments of the content and self-assessed learning outcomes. We believe this high approval to be due to allocating more time for in-depth involvement with the taught methods, their outcomes and reflection and its subsequent value for designing. In addition, when comparing the quality and quantity of discussions, comments and questions from the beginning to the end of the courses, we could easily see the students were often passionately engaged in their work processes (both within their teams, inter-teams and within the larger class) with many thoughts and ideas emerging. We happily enjoyed noisy active classrooms.

Motivating appreciation of the relevance and significance of the content of one course, the evaluation methods learnt (their analyses) were directly applied to the results produced in the other course (their re-designs) visibly impacting results and displaying direct value from the findings to the designs and design processes. Our students gained competencies with HCI design implementation and evaluation methods working directly with users while designing computational systems. The course structure allowed time to implement teachback and work directly with and reflect on user requirements in multiple instances. The paper proposes a two-fold approach to design and evaluation, focusing on acting, learning and understanding by using evaluation tools for real users and contexts to improve design outcomes. This study demonstrates solid potential to improve HCI educational standards for learning and design outcomes.

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