

DESIGNED FOR LEARNING: EXPERIENCES WITH THE INTENSIVE COURSE FORMAT IN INFORMATICS

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Abstract

Bachelor and Master courses at the Department of Informatics at the University of Oslo are semester-long courses. Students and teaching staff meet two to four hours every week for lectures and group work. This was also the case in Design, Use, Interaction, a two-year master programme. In 2013 it became possible to teach intensive courses in this Master programme, creating an opportunity to implement three intensive courses successively in one semester. This resulted in the development of two intensive courses and the intensification of another course, which was normally taught as a semester-long course: Tangible Interaction Design, Advancements in Interaction Design, and Design, Technology & Society. Each course was five weeks long. In a presentation of each of the three courses, we will focus on the opportunities and challenges in teaching an intensive course. The main question we will address is: What are the characteristics of a successful intensive course? Based on a literature review, we have identified the following attributes that play a central role in the success of an intensive course: course methodology, teaching methods, exam format, and lecturer-student(s) interactions. We will present our experiences in teaching intensive courses along these four attributes. Our findings and discussion centre around our constructivist learning methodology, implemented through a wide variety of methods enabling creativity, hands-on experiences, theory-practice nexus, and critical reflexivity; new and adapted exam formats; and constructive lecturer-student interactions. While the experiences from the three courses are different, we were able to extract three common attributes for success: i) create a 'learning home' for the students, which provides them with a common understanding of the course methodology and enables them to identify their learning experiences; ii) actively work with the theory-practice nexus, using the theoretical literature as a lens to understand practice and practice to construct new knowledge; iii) cultivate constructive lecturer-student and student-student interactions both on an individual, group, and class level.

1. Introduction

Intensive course formats have been around for more than a century (Seamon, 2004). A variety of terms are used in the literature to refer to the intensive course format (ICF), such as time-compressed courses, time-shortened courses, and accelerated courses. Compared with regular, semester-long courses an intensive course is short-term, taking place during a number of days or weeks, and offers a condensed, accelerated or compressed curriculum (Scott, 2003).

At the Department of Informatics of the University of Oslo, regular bachelor and master level courses are 10 ECTS¹ courses taught during a semester, with an evaluation (exam) at the end of the semester. The autumn semester runs from mid-August to mid-December and the spring semester runs from Mid-January to the end of May. Intensive courses, regular 10 ECTS courses that are taught and evaluated within a short time frame, were non-existent until 2012.

In 2013, Advancements in Interaction Design, was established as an intensive 5-week studio course for a limited number of master students in the Design, Use, and Interaction programme. Since then, two more intensive courses were added to this master programme: Tangible Interaction Design (2015) and Design, Technology & Society (2015). This paper presents a reflection on the intensive course format of these

¹ ECTS stands for European Credit Transfer and Accumulation System. ECTS are based on the workload students need in order to achieve expected learning outcomes and enables comparing this workload for higher education in EU and collaborating European countries.

three intensive courses. Based on the student evaluations, we can conclude that the intensive courses are successful. In this paper we will reflect on our experiences as course lecturers and discuss the question: What are the characteristics of a successful intensive course.

While not part of the discussion in our paper, we do want to acknowledge that intensive 5-week courses, in an institution-wide educational programme that is organised around semester-long (15 week) courses, is also an organisational challenge. The Department's administrative personnel needs to find lecture rooms that can be used for 3 to 5 full days for 5 weeks in a row. Our colleagues teaching regular courses in our master programme need to adapt the curriculum of their courses, so that students have the opportunity to mix long courses and intensive courses in their educational plan.

The remainder of the paper is as follows. In Section 2 we present an overview of the literature on the intensive course format. We end the review with the selection of four attributes that we deem central to a successful intensive course: course methodology, teaching methods, exam format, and lecturer-student interactions. In Section 3 we present the three courses; each of us wrote the section about the course we have designed and teach. We use the four attributes identified in the review to organise our descriptions. In Section 4 we use an inductive analysis to discuss our experiences and to formulate what we see as the characteristics of a successful intensive course.

2. Literature review

There is a considerable body of literature on the intensive course format. Research shows that intensive courses produce equivalent or better academic results as traditional courses (Austin & Gustafson, 2006; Daniel, 2000; Davies, 2006; Kucsera & Zimmaro, 2010a; Scott, 2003; Seamon, 2004). Academic results are often understood as learning outcomes (e.g., Davies, 2006; Kucsera & Zimmaro, 2010) and a variety of attributes are discussed to explain this success. Austin and Gustafson (2006) found that more intensive lecturer-student interactions result in better classroom relationships and classroom atmosphere. Scott (2003) compared two courses, an intensive and a semester-length course, with each course taught by the same instructor, covering the same material. Based on a comparative study involving student interviews and participant observation, Scott concludes that four main categories, instructor characteristics, teaching methods, classroom environment, and evaluation methods, decide the quality of the experience of an intensive course (see Table 1).

Table 1. Attributes of a high-quality intensive course (Scott, 2003)

Success Categories	Details	Positive Results
Instructor characteristics	Enthusiasm Knowledge, experience, and good communication Willingness to learn from and consult with students Student orientation (care about students)	More concentrated, focused learning More collegial, comfortable classroom relationships More memorable experiences More in-depth discussion Less procrastination Stronger academic performances
Teaching methods	Active learning Classroom interaction and discussion Experimental and applied learning Depth over breadth (course organization)	
Classroom environment	Classroom relationships Atmosphere	
Evaluation methods		

In an extensive review, Davies (2006) identifies key factors that contribute to successful learning outcomes in intensive course formats. These are "instructor enthusiasm and expertise, classroom interaction, collegial atmosphere, student input into class discussions, active learning, a relaxed learning environment and good course organisation". The overall success of an intensive course is, according to Davis the result of the course design: "good planning, well-organised and structured activities, a multitude of teaching strategies, a focus on learning objectives, and accurate assessment" (ibid).

In order to be successful, Daniel (2000, p. 6) mentions that course lecturers need different strategies than the ones used in traditional course formats: pre-course preparations, such as a good organisation of the

course and timely syllabus distribution, as well as creative variety of methods and approaches and clearly defined course outcomes.

Marques' (2012) review of research on the advantages and disadvantages of the intensive course format shows that they "usually deliver better prepared and more aware graduates" (p. 110). Lecturers and students have very different attitude towards intensive courses than towards traditional courses. Marques describes three attributes of this attitude, which form the main basis for success of the intensive course format: full commitment of lectures and students, low tolerance for absences during class, and students' feeling of ownership of the course.

2.1 Attributes of a successful intensive course

The literature shows that course design is central to the success of an intensive course. In the literature, course design is described in very practical terms, such as schedule, syllabus, and as part of a larger course philosophy. In other words, it is the course methodology that frames the course design. The course methodology expresses the theoretical perspective underlying the course and justifies the course methods and the evaluation format.

A second central attribute of a successful intensive course mentioned in the literature is related to the particular atmosphere and attitude found in an intensive course, which results in better learning, improved retention, and higher commitment. We see here a strong connection with course methodology: the particular schedule, course methods, and evaluation format result in different and more intense interactions between lecturer and students, resulting in improved relations and a better atmosphere in the classroom.

In the next section, we will describe our own experiences with the intensive course format. In order to organise our experiences, we will describe our experiences along four attributes that the literature describes as central to the success of an intensive course: 1) course methodology, with its 2) teaching methods and 3) evaluation format, and 4) lecturer-student(s) interactions. Each of the course lecturers will describe his or her course according to these four attributes.

3. Intensive master courses at the Department of Informatics

In 2013, Advancements in Interaction Design was the first intensive course offered in the Design, Use, Interaction study programme. After discussing how to better integrate Advancements in Interaction Design course in the master curriculum of the Design, Use, Interaction programme, we decided to offer the master students the possibility to have a semester with three intensive courses in a row. We designed a new course, Tangible Interaction Design, as well as intensified an existing course Design, Technology & Society. The two interaction design courses were organised as studio courses, and therefore offered only 12 places each to master students. Design, Technology & Society had no limit on enrolment and in 2017, 34 students participated in the course.

3.1 Advancements in Interaction Design

The Advancements in Interaction Design course was first created and taught in collaboration with Oslo School of Architecture and Design (AHO), following the studio course format that was already established at AHO. The course was offered jointly for the last time in 2012, and that year was considered to be a transition towards an informatics-based course. Teaching took place both at the Department of Informatics and at the AHO. In 2013, it was established as an intensive, time-compressed, five weeks long course at the Department of Informatics. The course kept the studio approach acquired from AHO, becoming the first of its kind at the Department of Informatics. The number of students who can take the course is limited to 12 master or doctoral students in the Design, Use, Interaction programme. The objective of the course is to explore relations between research and design with technology in Human-Computer Interaction (HCI). The course uses Research through Design (RtD) approach, which recently gained traction within HCI. RtD combines discovery and making. In that way, it opens for new knowledge that emerges from the integration of theoretical foundations with design experimentation, practical design work, and considerations regarding the use of made digital artefacts and their place in everyday life.

The course offers an opportunity for students to explore RtD and its implications for HCI. To make this possible, a previously completed course in HCI is required. There are no prerequisites regarding programming. However, both programming skills and familiarity with making, e.g., tangible interaction, are highly recommended. Students are assumed to have no background in traditional design or interaction design from schools of design, architecture, or art.

The learning outcomes include understanding of design practice and how it differs from the HCI-oriented design practice. The students learn methods, tools and techniques to increase their ability for reflection (including self-reflection), critical thinking, creativity, problem identification, and solutions finding. Students experience how it feels to expand the boundaries of the known through research, discovery, analysis, as well as synthesis, and making. They learn to tackle the unknown, and allow for gradual emergence of concepts, ideas, and material proposals through which the design context becomes familiar. They gain understanding of how design decisions and their implications are connected and, consequently, take responsibility for the proposed designs.

The learning unfolds through a combination of individual work and teamwork, implemented as a two-module sequence. The first module, dedicated to the individual learning, lasts one week and teaches each student, through making practice, the basics of a design process. The second module, four weeks long, is dedicated to learning in teams, on projects situated within some new (for the students in the course) design contexts. Both modules are based on full-time student engagement (40 hours per week). In this way, students give undivided attention to studio activities for the duration of the course.

The course syllabus consists of academic articles, chosen to support understanding of RtD, and diverse proposals that address the tension between the theory and the design practice. Lastly, a few articles that enable students to get familiar with a design theme are provided to situate the projects contextually.

The students spend most of their time in the studio, engaging in design practice and experimentation, either individually (first module), or in teams (second module). Some activities are plenary, such as lectures, weekly design critiques, or short presentations by students. Others unfold in smaller groups, such as diverse types of feedback, dialogues or discussions of articles.

Course methodology

The course methodology is based on the academic studio approach (Cennamo & Brandt, 2012; Reimer & Douglas, 2003; Salama & Wilkinson, 2007) and experiential learning (Kolb, 1983). The academic studio approach represents a coherent system where surface structures, pedagogy, and epistemology interact to create a unique learning environment (Culén, Mainsah, & Finken, 2014; Shaffer, 2007). Surface structures refer to components of this learning environment such as space, furniture, tools, materials, activities, and tasks. The studio approach is based on the epistemology of practice. Traditionally, the apprenticeship model is used in learning design and architecture. The approach adopted for the course, however, takes a turn towards experiential and constructivist learning (Jonassen, 1999; Kolb, 1983). This implies that students construct knowledge themselves, each one individually and socially (through teamwork and communication with the instructor), and construct meaning as they learn. Learning unfolds through concrete experiences, abstract conceptualization, reflective observation, and active experimentation. Concrete experiences and abstract conceptualization help students to grasp their experiences, while reflective observations and active experimentation help them to process the knowledge and create meaning.

The main challenge for the instructor in such a course environment is how to select relevant perspectives, concepts, methodologies, and themes to successfully engage students in experiential learning (Schön, 1983, 1987). Furthermore, how to sequence the course activities, and blend the training of academic research skills with the training of design and making skills, is crucial.

Teaching methods

The course uses diverse methods, tools, and techniques to engage students in experiential learning, as well as to make them understand and reflect on their learning processes and enable them to build awareness of how they think and gain new knowledge.

Active experimentation and making, in conjunction with more conceptual work, generate experiences of bridging the concept (abstract) - artefact (concrete) gap. Making mood boards, storyboards, finding and communicating exemplars from previous work, discussing relevant or related concepts, creating workbooks, experimenting with materials, form, and function through rapid and high-fidelity prototyping are examples of activities that support understanding and consequences of design choices and decisions made, see Figure 1.

Reflection is accomplished in several ways. Students learn how to reflect in action while being engaged in design practice. Reflection on actions implies looking at work from a more distant and abstract point of view, connecting trajectories and making sense of own actions.



Figure 1. a) a typical classroom at the Department of Informatics b) stencilling an exhibit booth that when done, featured digital secrets sharing c) the end of the course celebration and reflection session.

Furthermore, traditional design critiques (crits), where students are exposed to professional and peer critique, are also means of engaging in reflection and self-reflection. Through individual conversations between the instructor and a student, a team of students, or in the plenum, as well as conversations among peers, students hone communication skills and learn to think critically.

Experiencing the unfamiliar, unknown and uncertain is an integral part of design practice and fundamental to its learning. The most recent course offered a theme related to dance and technology, while the two preceding years engaged students with machine learning and sustainability through design. These design contexts were, with very few exceptions, new and unfamiliar for students.

Creativity is also paid attention to and nudged in different ways, for example, by using limited materials supply, which engages students in bricolage, considering assemblages of things or skills, learning to function well outside the comfort zone, engaging the body, etc. (Finken, Culen, & Gasparini, 2014).

Exam format

The students spend nearly the entire course time engaged in design practice and artefacts making. The culture formed in such environments promotes self-monitoring regarding presence or absence, and most students successfully self-regulate the time spent in the studio. Through studio work and design practice, an answer to the design challenge (in the form of the designed artefact) is given. This, naturally, invites for final evaluation of the work that differs from the usual exam practice at the Department of Informatics. It is important to examine the artefact and hear about the knowledge gained by making it, and how the artefact embodies this knowledge. The format adopted for the exam is therefore a final exhibit of the artefact, in conjunction with articulation and communication of knowledge gained through the experiential learning process. So far, the final presentations and exhibits of designed artefacts have been open to all students and faculty from the Design, Use and Interaction study program, as well as to an external (outside of the Department of Informatics) and an internal examiner. The grade for the course is pass/fail.

Lecturer-students interactions

The communication between the instructor and students, as well as among students is central to the studio approach. As the instructor is engaged in teaching beyond occasional lectures (which are the least popular

knowledge transfer method in this context), a more careful preparation for the course is required to provide new challenges and unfamiliar context for design and regarding running the course. As mentioned, the latter requires presence in the studio on a daily basis, providing crits, feedback, engaging in dialogues, demonstrating the use of tools, and many other tasks that make things work in a studio. Students thus have ample opportunities to approach the instructor with problems, but also to learn directly from the instructor.

The instructor also helps create a dialogical space where students talk to each other freely. Working in a studio setting at Informatics provides an unusually open forum for knowledge sharing among students. They are expected, and encouraged, to help each other and share their time with each other, also because they often have different skills. Without this sharing culture, many projects would be less successful.

3.2 Tangible Interaction

The Tangible Interaction course has been given four times since 2015 as five-week intensive studio courses requiring full-time commitment (i.e., 40 hours attendance per week). The course follows week-based milestones with each week including lectures, design critique sessions, workshops, and summarizing presentations. The student work towards an exhibition as their final form of delivery, which usually demands additional hours of work from students during the two final weeks. The course has a capacity of 12 Ph.D. or master students and requires previous experience with project work involving physical interaction. As such, students are expected to have basic knowledge of basic programming and hardware including familiarity with the use of microelectronic components in an interaction design context.

The students are divided into three groups of four students that work together for the five-week duration of the course. All lectures, workshops, and presentations are held in a design lab. This design lab provides access to essential tools and materials and where the students are given storage space. As a result, the students spend almost all of their time in this design lab, mainly leaving it only to work in special equipment rooms (e.g., laser cutter room or 3D printer lab) or to buy equipment or materials.

The learning outcomes are both theoretical and practical. The theoretical learning outcomes rely on theories of embodiment following a phenomenological approach to understand, define, and analyze the design and use in the context of tangible interaction. Students learn how to apply seminal frameworks from the literature to structure and reflect critically upon their own projects and concrete design cases. Furthermore, the students learn how to use prototypes not only as manifestations of conceptual ideas but also as design tools to explore new ideas and open up new spaces for inquiry through reflection. The practical learning outcomes revolve around common methods and techniques of rapid prototyping when working with physical design. Students learn how to operate design equipment such as 3D printers, laser cutters, CNCs, vinyl cutters and plotters, and they also learn how to use the associated software. Also, the workshops teach students how to work with microelectronic components and computational composites (Vallgård & Redström, 2007), as well as how to understand, use, and analyze material properties in internal and external design exemplars.

The course covers a different thematic area in the context of tangible interaction for each time the course is given, with “Ludic Design” (Gaver, 2012) being the thematic area for the latest edition of the course. The curriculum consists of mainly academic research papers. The first half of these papers are dedicated to seminal bodies of work within the field of Tangible Interaction and is usually not changed much between each edition of the course. The second half of the papers changes with each edition of the course to reflect the particular thematic area covered. The supporting syllabus consists of inspirational design exemplars and self-selected secondary literature that the students decide on, with approval from the course instructor.

Course methodology

The course methodology follows a collective constructivist learning approach, i.e., collective sensemaking both within each group but also across the groups during common presentations and design critique sessions. The course is designed to let student actively construct their learning through design by focusing heavily on practical learning outcomes through the dynamic use of workshops and exhibitions. An imperative property of the studio course format is the full-time commitment to the project for the

duration of the course. The rationale behind the dedicated engagement into one single course at a time is that it facilitates learning that is only attainable by immersing fully into a creative process without disturbance from other simultaneous teaching activities. To further support active and collective learning, the students are given access to the design lab as a dedicated arena where they can spend most of their time. This arena enables learning by offering an isolated and creative space where they can use the design lab freely to foster a collective constructivist atmosphere supporting the creative processes involved in the course. While the course offers some scoping of learning outcomes in the form of a predefined thematic area and a provided design brief, the students are expected to shape parts of the learning themselves through self-selection of secondary literature as well as relevant and inspirational design exemplars.

Teaching methods

The course depends on a combination of methods to support both theoretical and practical learning outcomes. The primary method is workshops that support practical learning. The workshops focus on the introduction of methods, tools, or techniques that support rapid prototyping that the students then explore in the context of their own project work. Other faculty or external collaborators are usually invited to give half-day or full-day workshops on their particular topic of expertise, i.e., a full-day wood workshop where students learn about material properties of different types of wood in the context of physical design through active exploration and practical tasks. All workshops are organized as common activities to support a collective learning experience, see Figure 2. This is one of the reasons for the strict capacity of 12 students; any more students than 12 would not support this collective learning atmosphere given the physical size of our design lab.

Two other important methods are design critiques and presentations. During each week, the groups present their work to course instructors and co-students in a design critique session where they learn by giving and receiving critical opinions on each other's design processes and prototypes. At the end of each week, the groups also present their work to an external audience consisting mainly of faculty, Ph.D. fellows, and other master students. Both these methods support students in learning how to document and articulate their own design processes, experiences, prototypes, and reflections.



Figure 2. Examples of practical workshops held in the lab.

One particular method applied to support theoretical learning outcomes is flipped classroom where students attend discussion around curriculum after having read papers and prepared presentations ahead of time. The discussion focuses on the relevance of the curriculum to their own group-based design explorations, thereby allowing students to read and interpret the theoretical curriculum anchored in their own practical work. The students also have to work with self-selected theoretical constructs from the curriculum to support their investigations of own prototypes.

Exam format

The course has explored different types of exams throughout the years. In the first two editions of the course, all students were required to write a 10-page individual report where they reflected upon their design process and the outcomes by using the theoretical curriculum. They also included an oral exam focusing on the students' ability to apply the theoretical curriculum as analytic tools. The third and fourth

editions did not have any other formal exam besides the final exhibition and guest lecture but added additional requirements to the format and expectations of the exhibition.

A common part of passing the course for all four editions of the course has been a final exhibition and a guest lecture. During the first two editions, the course instructors organized the exhibition while the students provided the content, but in the two last editions the students have also been asked to organize, document, and reflect upon the exhibition as a part of their five-week schedule. All four editions of the course have also required that the students present their design processes to first-year students in a beginner course with 200 bachelor level students and then give them a mini-exhibition about two weeks after completing the course. This is the only activity outside of the five-week duration of the course, and it has been scheduled as such to offer the students enough time and distance to engage in a final session of collective reflection before giving an overarching presentation of their work. The grade for the course is pass/fail.

Lecturer-students interactions

The course is designed to involve a frequent dialogue between the course instructor and the students. The course instructor has multiple interactions with each group on a daily basis during the five weeks of the course, albeit in different formats and durations. This is another reason behind the maximum capacity of 12 students. The aforementioned flipped classrooms offer an arena for discussion where the students can ask questions and help the instructor pinpoint gaps in the students' understanding of the curriculum. Allowing students to self-select secondary literature also helps to facilitate active engagement in the materials of the course (Scott, 2003, p. 31), which further enables communication.

The students also interact with the instructor through the multiple workshops each week. One of the main challenges of the instructor is to continuously adapt the practical workshops to suit the skill levels of the students through dialogue. Thus, the course intrinsically depends on the recurring and structured interaction between the instructor and the students to facilitate a collective learning approach. Another important characteristic of the course enabling frequent instructor-student interaction is the twice-a-week design critique sessions where the students have to reflect upon their own group-work and structure a presentation summarizing their learning. These sessions enable communication between instructors and students and help to stabilize expectations on both sides of the table.

3.3 Design, Technology & Society

The Design, Technology & Society course² has been taught since 2005 as a semester long course. In 2015, the course was for the first time taught as an intensive course. The course is designed for master and Ph.D. students in the Design, Use, Interaction programme at the Department of Informatics, but has also accepted students from other programmes at the Department, as well as exchange students from foreign universities.

The main objective of the course is to explore the relations between technology and society, with a focus on the social, political, and ethical dimensions of technology and how these, in turn, intersect with society; in particular, the linkages between design, technological change, and current societal challenges, such as automation, inequality, sustainability, privacy and surveillance, etc.

The learning outcomes focus on understanding and theorising the relations between technology and society. The course provides students both the knowledge as well as practical tools to engage with the social and ethical challenges in technology design and use and to participate in critical and reflexive discussions of new and emerging information technologies and the social and ethical responsibility of the information technology developer/designer/innovator.

The course takes place on three days a week, from 10:00 to 16:00; enabling students to participate in semester long courses on the two other days. Some course activities are plenary, while most course and project work take place in smaller groups.³ The allotted time also enables students to work on the course project. The course syllabus consists of academic articles plus a reading guide with questions about the

² This course has been taught under different names. The previous name was Science Technology Society Ethics.

³ We had 9 small project groups in the 2017 edition.

different texts. The course website provides access to a large amount of secondary literature (academic, reports, videos, news articles, etc.), organised by theme.

All students will work on a course-long project in smaller groups of 3-4 students. Project work focuses on deconstructing popular or new digital technology, exploring and engage with the underlying political, social, environmental, and gender relations of technology. This project work is based on literally taking a digital device apart until its smallest units and studying its design and other materials aspects. This work is supported by the course curriculum as well as short plenary lectures on topics such as lifecycle thinking, sustainability, ethics, and business and human rights.

As part of the critical and reflexive approach taken in the course, the students are not allowed to use any digital devices in class unless working on their projects. This means that the mandatory course curriculum is only available on paper and that all students use pen and paper to make their course notes. This facilitates a very personal engagement with the role of technology in the students' studies, lives, and society as a whole.

Course methodology

The course methodology is based on critical constructivism (Freire, 2000, 2013; Kincheloe, 2005) and is supported by a constructivist classroom design (Gagnon & Collay, 2001). Critical constructivism, and the learning theories and pedagogies derived from this perspective, e.g., (Bentley, Fleury, & Garrison, 2007; Kincheloe, 2011; Scheer, Noweski, & Meinel, 2012), is based on the understanding that learners are actively involved in knowledge creating processes and that teaching within this perspective includes engaging learners in analysing, interpreting, and constructing knowledge from different sources and in different formats.

A constructivist classroom design supports such a constructivist learning process. It consists of six elements: situation, groupings, bridge, questions, exhibit, and reflection (Gagnon & Collay, 2001). The *situation* frames the goal, tasks, and forms of the learning episode. The course has several situations. Each year, these situations are evaluated and adapted to current developments and concerns in digital technology. *Groupings* refers to the different configurations of the learners as well as the different groupings of materials used during a learning episode. The groupings for the project groups is based on input from the students, such as their background, master project, hobbies, interests, etc. *Bridge* is the initial activity to establish what knowledge the learners already have. We use the course introduction to initiate a discussion on different understandings of the relations between technology and society. For the different *situations*, we use a short video to explore the students' own experiences at the start of a new situation. *Questions* are mainly about inspiring, stimulating, and extending student thinking and communication. The course curriculum is accompanied with a reading guide containing questions to reflect on texts and videos. New questions are formulated all through the course in order to encourage the students to explain their thinking and learning. *Exhibit* takes places during the course in the form of different visualisations of new understanding as well as at through the presentation of project work at the end of the course. *Reflection* is enabled through several small essays written during the course as well as the final essay written at the end of the course.

Teaching methods

The course uses a mix of methods to engage the students in learning and applying their new understanding. The flipped classroom strategy requires the students to engage with the course curriculum before they come to class. In class, they have the opportunity to ask questions about the text and will then engage with the text through different methods. These methods are, among others, documentaries or short videos followed by a discussion, visualisation through mind mapping or collage (Figure 3), a short lecture with discussion or research plus short presentation on a related topic.

A large part of the course consists of group-based project work. The students are organised in smaller groups and implement a variety of exercises, such as taking apart a small electronic device (popular consumer electronics, such as a mobile phone, training tracker, headphones, VR goggles, etc.) and urban mining of old mobile phones. These exercises form the basis for research in sustainability, the politics and ethics of digital technology, as well as the reparability of consumer technologies.

The plenary lectures and discussions are always combined with short individual or small group (2-4 persons) assignments, enabling the students to engage with the new information through the discussion of personal experiences, application of the course curriculum, and through additional exercises, such as mind-mapping and visualisations.



Figure 3. a) poster map of the social and ethical aspects of a tracking device for children; b) 'deconstruction' of a mobile phone; c) handwritten course notes of student Cathrine Kieu Trang Bui.

Writing exercises form an important method in the course. Each day ends with a micro-writing exercise (Dysthe & Hertzberg, 2006). All students use a pen and notebook to write continuously for three minutes, reflecting on the activities of the day. The next day, the students are paired and use their micro-writing as the basis for a short conversation about the previous day. In addition, each student has to submit during the course three short essays. The topics of the first two essays address the larger themes that guide the course, such as ethics of emerging technologies and theories that can help to explain technology-society relations. The last essay is a hand-written essay reflecting on the experience of working with pen and paper. The students are involved in the peer assessment of their fellow students' essays.

Evaluation format

Consistent with the constructivist learning methodology, the evaluation format offers the students the opportunity to both present and exhibit what they have learned, through a plenary presentation or exhibition, and to reflect on what they have learned, in the form of a long essay. There are several classroom-based exhibits of student visualisations, exhibiting their understanding of the topic under discussion, as well as a final presentation of their project work. The topic of the long essay is open, enabling the students to reflect on what they have learned during the course and/or to discuss the topic of their master thesis in the context of what they have learned in the course. The students can start working on the essay during the course. The deadline for the submission of the essay is two weeks after the last course day. The exam essay is graded A-F.

Lecturer-student(s) interactions

The constructivist classroom design enables on-going open and critical dialogue and interactions between lecturer and the students. The lecturer's questions play a central role in initiating and maintaining on-going lecturer-student interactions. The flexible course design enables students to ask questions whenever they come up and to intervene in the curriculum, requesting the lecturer to add new resources or to give more attention to a particular topic or theme. Feedback on the short essays during the course and commentary on exercises are another venue for interactions.

4. Designed for Learning

The three courses described above were designed independent from each other. We have discussed if we could better find a way to integrate the courses, but this discussion focused mainly on if and how we could allow students, who take all three courses in one semester, to work on a project that they would take from one course to the other, but this never materialised. Working on this paper enabled us to reflect

together on how we worked in our courses. Our descriptions along the four main attributes of an intensive course enabled us to see how close we are in the details of course implementation (see Table 2).

Table 2. Commonalities of intensive courses in the Design, Use, Interaction study programme

Attributes	Details	Positive results
Course methodology	Constructivist methodology Integrated course design Active learning Full-time commitment	Critical reflections Open dialogues Deeper understanding of the theory-design/practice relationship
Teaching methods	Practice-oriented Design critique/criticism Flipped classroom	Good understanding of the relation between course activities and learning outcomes
Evaluation format	Exhibition Reflection	More engaged and committed students
Instructor-student interactions	Frequent dialogues (discussion, Q&A) between lecturer and class, groups, and individual students Feedback on student work	Good ratio of structured and exploratory activities All students are seen and heard

4.1 Details

What we have in common is a constructivist course methodology. The courses are designed with great care, based on constructivist learning theories. Each activity in the course contributes to achieving the learning goals. We found that an integrative course design generates a kind of scaffolding, which we use as a “structuring device” (Davis, 2015), enabling students to see how different steps and artefacts used in the course are pathways towards the final learning goals. At the same time, the integrative design of learning goals, teaching methods, and evaluation format provides more than each of its three parts suggest. Creating an integrative whole enables students to construct multiple learning pathways to reach both the learning goals as well as their own goals in the course.

To facilitate a learning environment that supports constructivist learning, we have emphasized opening up spaces where they can quickly revisit and reflect upon recent learning outcomes. For example, in the Tangible Interaction course, we focused on frequent presentations that enable reflection on both group level and classroom level, as the students engage in student-to-student dialogue, while in the Design, Technology & Society course, we have focused on ending the days with individual reflective micro-writing exercises followed by student-to-student discussions. We found that the pairing of frequent reflective exercises and a strong peer relationship between students constitute a characteristic of our approach. Scott (2003, p. 33) suggests that these strong peer relationships can increase the learning outcomes. This continuous confrontation and reflection upon typical challenges associated with design situations (uncertainties, ill-defined and complex problems, complexity etc.) moves students along the trajectory towards ultimately resolving their given exercises in line with constructivist learning principles (Jonassen, 1999).

Another common characteristic of our three courses is the intertwining of theory and practice. Each course is carefully structured to facilitate specific movements between theory and practice that supports the intended learning outcomes. The manifestation of each course reflects the role we believe the design practice should have in developing new knowledge, and vice versa, i.e., how the theoretical literature can support practical learning. Furthermore, the specific choices of methods and practical activities reflect how encouraging the development of new skills is part of a theory-practice nexus, in which the practical learning outcomes are part of how the students learn to read and use the theoretical literature. The intensive format supported the creation of artefacts and exhibitions that expressed a more intense engagement with theory (concepts) and that were of a higher quality. This enabled in addition a higher level of design critique as well as design criticism.

While the courses are planned ahead, all our courses offer space for lecturer-student dialogue to shape parts of the learning outcomes. In one course, the practical exercises are designed to complement the students’ existing skills and are continuously adapted throughout the course as students attain practical skills and familiarity with tools and techniques. In another course, the students are allowed to bring in

their own perspectives and interests in the context of the courses theoretical literature to self-define parts of their own practical learning outcomes. The flipped classroom method played a central role here, creating not only different expectations of the role of the instructor, but also supported more active instructor-student and student-student interactions (Bergmann & Sams, 2012).

The evaluation format, in terms of grading scale, differs significantly between the two studio intensive courses (pass/fail) and the more traditional intensive course (A-F), but all three courses focus on exhibition and reflection to express the students' achievements. Exhibition and evaluation creates greater ownership over the final results, being it an artefact or essay, thus focusing more on the learning achieved than on the grade'.

In terms of instructor-student interactions, there are two issues that stand out. Our courses require full commitment of the instructor to instructor-student interactions. We see it as our responsibility that all students are seen and heard, individually, in groups, and in plenary activities. Secondly, we find that student-student interactions are not less significant for a successful intensive course. Students working in groups, reading, seeing, and evaluating each other's work, and engaging in discussions, create an environment in which their values and commitment are tested and explored. It is especially in student-student interactions in which students learn to give and receive critique and to think critically.

4.2 The positive results

We found a large number of positive results that characterises our intensive courses (see Table 2). This paper does not present a comparative study of semester-long courses versus intensive courses, nor presents student evaluations of our courses. Based on our experiences in teaching semester-long courses, we do find that the intensive course format supports a learning environment that is more inductive to experimental teaching methods, improved understanding of the role of theory in practice and the contribution of practice to theory-building (theory-practice nexus), and a deeper level of reflexive thinking, in which students are able to argue from other standpoints than their own. This is, we argue, because it is exactly the intensity of instruction that brings the positive results in our courses. Being together 3 to 5 days, all day, generates a safe learning environment, deeper engagement with the course curriculum, and more committed students.

4.3 Significant difference

The differences between the three intensive courses are mainly the result of the design approach in the courses. Advancements in Interaction Design and Tangible Interaction are studio courses with a focus on making, while Design, Technology & Society is a more traditional intensive course and with a focus on un-making and re-making. A significant difference here is that the Design, Technology & Society course has a more structuring course methodology (Gagnon & Collay, 2001), while the two studio courses use also surfaces as a structuring device (Culén, Mainsah, & Finken, 2014; Shaffer, 2007). As a result, the final activity in the two studio courses is an exhibition of artefacts, which is evaluated with a pass or fail, while the final activity in Design, Technology & Society is a long essay, which is graded with A-F.

5. Concluding remarks

Concluding, we propose three overarching attributes for the success of our intensive courses. The first is the importance of *creating a learning home* for the students, which provides them with a common understanding of the course methodology and enables them to identify their learning experiences. This learning home is the result of a well-communicated constructive course methodology, which is applied through an integrated course design. A 'safe' learning home enables learning and exploration. The second attribute is *pro-active engagement with the theory-practice nexus*, using the theoretical literature as a lens to understand practice and practice to construct new knowledge. The third overarching attribute is the *cultivation of constructive lecturer-student and student-student interactions*, both on an individual, group, and class level. It is the combination of both lecturer-student interactions and student-student interactions that create engaged and committed students, which greatly enhances reaching the learning outcomes.

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