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Onboarding new talent to Child–Computer Interaction research: Teaching a tasting menu of CCI as an elective research subject

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ABSTRACT

We present a case study in which we seek to investigate what motivates interaction design students to take a small elective course in Child–Computer Interaction (CCI) and what we can offer as a 'tasting menu', a small sample of emerging research specialties, to awaken their interest for CCI. The study clarifies what motivated students to take the elective course and what their learning expectations were before the start of the course. We then prototyped and piloted a research-based 'tasting menu' type of course and conducted a formative and summative evaluation with the students. The contribution of this paper is a set of recommendations for onboarding new talent to the research field by teaching CCI in a modular fashion to interaction design students, based on students' and teachers' experiences.

1. Introduction

Child–Computer interaction (CCI) is a field of research within Human–Computer Interaction (HCI). It has had its own conference for 20 years, Interaction Design and Children (IDC), and a dedicated journal, International Journal of Child–computer interaction (IJCCI), for about 10 years. In these, and many other related venues, we meet the highest standard of research within CCI, however, there is a lack of continuous discussion on how and what to teach students in CCI and how to onboard new talent which is crucial for advancing and maturing CCI as a well-established research field. There has been a few workshops on teaching CCI (Calefato et al., 2014; Eriksson, Torgersson, Calefato, & Ferrarini, 2014; Gilutz, Bekker, Fisch, & Blikstein, 2011; Van Mechelen, Gilutz et al., 2020), which typically offers a forum for CCI educators to share teaching experiences. There are also a number of papers discussing or evaluating a CCI curriculum (Bekker, Barendregt, Markopoulos, & Read, 2014; Eriksson & Torgersson, 2014, 2015; Ferrarini, Eriksson, Montanari, & Sims, 2013; Read, 2011), including how to work with pedagogical approaches such as a constructively aligned approach (Biggs & Tang, 2003). Additionally, there are also a few experience reports from teaching CCI e.g. Eriksson, Barendregt, and Torgersson (2021) and Eriksson and Torgersson (2021) with a focus on students' perspectives on ethics and from formulating learning goals in participatory design with children.

In this paper, we report on the design and evaluation of a CCI 'tasting menu' course for master students in interaction design, aiming to awaken their interest in studying and researching CCI in the future. Particularly, we focused on supporting students' understanding of specific characteristics of CCI research and why they should take into account working in this field for their future careers. The contribution of this paper is to introduce the concept of a tasting menu course as an approach to teaching CCI, and provide a case study of such a course that can serve as an inspiring example for those who intend to teach CCI, but may not have the capacity to cover the whole field, and who seeks to awake an interest in students.

2. Background

Despite the CCI community's rapid growth in the past two decades, there has traditionally been less focus on developing a curriculum on what and how to teach CCI to students (Van Mechelen, Gilutz et al., 2020). A number of papers have reported on teaching design approaches from various related sub-fields of Human–Computer Interaction (HCI), such as tangible and embedded interaction design (Martin & Roehr, 2010), interaction design and children (Eriksson et al., 2014), digital craft (Nitsche, Quitmeyer, Farina, Zwaan, & Nam, 2014), interaction design with a focus on sensor-based interaction (Brynskov, Lunding, & Vestergaard, 2012), participatory design (Christiansson, Grönvall, & Yndigegn, 2018; Hecht & Maass, 2008), ethnography in human–computer interaction Weinberg and Stephen (2002), and interaction design by research through design (Hansen & Halskov, 2018). We have also seen a need for more discussions around teaching various

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strands of design of technologies, such as in CCI (Van Mechelen, Baykal, Dindler, Eriksson, & Iversen, 2020a), in HCI (Eriksson, Nilsson, Hansen, & Bekker, 2022), and in participatory design (Hecht & Maass, 2008), to name a few.

A total of three workshops have been held at IDC conferences on the topic of teaching CCI. The workshops resulted in a number of publications on teaching CCI in the years thereafter (e.g. Bekker et al. (2014), Calefato et al. (2014), Donoso, Verdoodt, Van Mechelen, and Jasmontaite (2016), Eriksson and Torgersson (2014), Eriksson et al. (2014) and Ferrarini et al. (2013)). Read discussed decisions about the content and goals that went into the design of several CCI courses. The topics of these courses reflect 'the nature of CCI' (Read & Bekker, 2011) and include, among other things, the differences between children and adults, accessibility and ethics, novel interaction techniques for children, gathering requirements, and evaluating products with and for children. Building on this work, Eriksson and Torgersson suggested a 'constructively aligned approach' to teaching CCI. They argued that to facilitate students' meaning-making, CCI topics should be aligned with teaching methods and learning objectives. The objectives should be stated in such a way that it is clear to students what skills and knowledge they should be able to demonstrate after the course, and the teaching practice should be designed to help students to reach these objectives (Biggs & Tang, 2003). In a follow-up publication, they discussed how they applied the constructively aligned approach in a CCI course and what lessons they learned (Eriksson et al., 2014). A key lesson is that, compared to previous courses, the approach improved students' domain-specific knowledge about CCI and practical insight for working with children, but it did not necessarily improve the novelty and quality of students' designs. Other papers on teaching CCI focused on bridging the gap between child development theories and interaction design (Bekker, Bakker, Douma, van der Poel, & Scheltenaar, 2015), and on training students to design for vulnerable populations in a quest for more inclusive design (Calefato et al., 2014).

As HCI researchers are designing and evaluating technologies in increasingly sensitive and challenging settings, it has become crucial to consider and plan for ethical issues when conducting research involving people in those settings. Research that involves vulnerable or marginalized participants can produce complex ethical dilemmas that are often emergent, diverse, and embedded in the context in which the research takes place (Waycott et al., 2017). In the broader field of HCI, several authors have also called for initiatives to address ethics in teaching design e.g. Fiesler, Garrett, and Beard (2020), Frauenberger et al. (2019), Lilley and Lofthouse (2010), Nilsson et al. (2020) and Pillai et al. (2021). Overall, there is an increased focus on ethics in CCI (Van Mechelen et al., 2020a) and many researchers in CCI find ethical considerations central to their work (Antle et al., 2020). They value adherence to ethical considerations that are explicit in nature (e.g., consent process) as well as implicit in the structure of their research (e.g., agency) (Kawas et al., 2020). In spite of the increased focus on ethics in CCI, a recent literature review on 18 years of ethics in CCI research, demonstrated that while ethics is frequently mentioned, the literature remains underdeveloped in a number of areas, including definition and theoretical basis, the reporting of formal ethical approval procedures (ethics determined by laws, norms and guidelines), and the extent to which design and participation ethics are dealt with Van Mechelen et al. (2020a). Despite various initiatives in recent years, such as panels on ethics (Frauenberger, Antle, Landoni, Read, & Fails, 2018; Frauenberger et al., 2019), a keynote (Antle, 2017), workshops e.g. Antle et al. (2020), and the mandatory section on the formal procedure for "selection and participation of children" in the IDC and IJCCI paper template, this has not yet led to an increase of papers dealing with critical cases of situational ethics (how we can think ethically about specific issues) during the research and design process (Van Mechelen et al., 2020a). In spite of the increased focus on ethics in CCI, there seems to be a lack of discussion in the CCI community about practices for teaching ethics in CCI (Eriksson et al., 2021). Pillai et al. recently argued that beyond defining ethics, an ethics curriculum must enable practitioners to reflect and allow consideration of intended and unintended consequences of the technologies they create from the ground up, rather than as a fix or an afterthought (Pillai et al., 2021). In CCI, this is picked up by Eriksson et al. (2021), who share the experiences of ethical dilemmas from master students, with the hope to support teachers across, a range of educational and cultural contexts to educate ethically responsible CCI designers of the future. They further see an opportunity and need for developing educational materials on ethical matters and practices in CCI for novices (Eriksson et al., 2021).

In the rest of this paper, we will present the design and experiences from running a CCI course with master level interaction design students. Our course was conducted as a "tasting menu" of current CCI research. In gastronomy, tasting menus denotes a sample of a type of cuisine, a house specialty, or to take advantage of fresh seasonal ingredients. We use tasting menu as a metaphor when introducing interaction design students to engage in emerging CCI research and treats CCI as a house specialty in Interaction design education. Through this, we contribute to the discussion on what and how to teach CCI in Interaction Design, and inspire others to share their experiences from onboarding new talent in CCI research.

3. Method

The course described in this paper is an elective course (10 ECTS) for students in the first year of a master level program in information studies. The students received final grades in the format of "passed" or "failed". Hence, we made no formal assessment of their learning gains or performance and focused instead on their self-perceived learning. The course was built up around 13 lectures of 3 h each during 13 weeks. The participants were 13 students (female = 2; male = 11). The students have a BA background in information studies, that aim to qualify students to perform business functions related to research, development, introduction and use of technology in organizations, working practices and everyday life, development and implementation of user driven design processes, digital communication, as well as business analysis and development, focusing on the role of information technology in businesses and organizations and investigate the interaction between people and technology. The Master's degree programme in information studies (in which the course was situated in the second semester) focuses on information technology and the potential, problems and consequences of digitalization by using ethnographic, digital methods and user-driven design approaches.

The course is research based, meaning that the content is tightly connected to ongoing research at the department of the university and taught by researchers. This leads to that the design of the course is highly colored by the available educators and their research, rather than taking the approach of trying to cover a basic course in CCI (as e.g. Eriksson et al. (2014)). Further, we took advantage on the fact that we have a strong CCI research group at our university, with researchers focusing on a wide range of areas within the research field. Taking this as a starting point, the themes and readings were defined quite early in the process. The ambition was to strive for the principles of constructive alignment (Biggs & Tang, 2003), where the design of the course is based on a set of intended learning outcomes for students, describing the skills they should be able to demonstrate upon completing the course based on SOLO taxonomy (Biggs & Tang, 2003).

Data Collection and Analysis: The students were asked for input for the course on three occasions, expectations before the course started, midterm formative evaluation, and for a final summative course evaluation.

Expectations: before the course started, the students were contacted via email to share their motivations and expectations before the course. At the beginning of the first lecture, we discussed the feasibility of changes based on students' expectations. Among others, we clarified

Table 1
Overview of the course.

Tasting menu course in Child-Computer Interaction		
Theme	Learning goal	Activity & Literature
Introduction to CCI	- Identify and describe principles of CCI research	- Literature: Hourcade (2015) Ch.1, Read and Bekker (2011) - Lecture: Introduction - Exercise: Childhood toy - Plenary discussion
Module 1: Embodied Interaction		
Module 2: Making and Tinkering		
Module 3: Co-design with Children		
Three modules and relevance for CCI	- Perspectivate CCI in industry - Compare application of CCI research across sectors	Industry Speaker talk: "Learning through Play"

that the course would give them a 'tasting menu' of selected themes in CCI instead providing them with a general overview of theories, methods and tools within the field.

Formative evaluation (midterm): A formative evaluation was undertaken in class during the middle of the course. The evaluation consisted of four questions Q1: Do the course contents and activities meet your expectations?; Q2: In which course activities did you learn the most? Why?; Q3: In which course activities did you learn the least? Why?; Q4: How could the course be improved?, and administrated through a digital questionnaire form. The anonymous results were discussed in class. Summative evaluation (final): the summative evaluation was undertaken using the university's standard digital tool for course evaluations. The evaluation took place during the second last teaching of the course, and the anonymous results were discussed during the final teaching occasion of the course.

Finally, in the last class the students were asked to write their self perceived learning gains about the three models on post-it notes which were then presented during a plenary discussion.

We used content analysis to identify the patterns that emerge from the data by grouping the content into themes related to students' (1) expectations, (2) self-perceived learnings and experiences and (3) suggestions for improvements for the course (Harwood & Garry, 2003).

4. The research based CCI 'tasting menu' course

The course was organized as three interchangeable modules in the context of CCI: (1) Embodied Interaction Table 2; (2) Making and Tinkering Table 3; (3) Co-Design with Children Table 4, see Table 1. Together, these modules provided a 'tasting menu' of current research in the field of CCI. Each module was led by a different instructor, 2 post-doc researchers and 1 Ph.D. student. The modules included lectures, plenary discussions, recap exercises of key literature and team-based group work with mandatory oral presentations. We furthermore engaged the students in real-life practices. For instance, in the 2nd module on Making and Tinkering, they visited the FabLab and observed teachers during their in-service training. In Module 3, they planned and conducted a co-design session with 4th grade students from a local school. In the first lecture, the students received a general introduction to CCI research. For the final lecture, we invited a speaker from industry, who talked about methods for "Learning through Play" and provided through this the students a perspectives how their knowledge and skills can be applied to the industry sector.

In the following, we describe the teaching methods, course contents and materials used in each module.

Table 2
Overview of Module 1 on Embodied Interaction.

Module 1: Embodied Interaction		
Theme	Learning goal	Activity & Literature
Introduction to embodied interaction	- Identify and describe key concepts in embodied interaction - Discuss considerations in design of embodied learning experiences - Relate children's abilities at different ages to design	- Literature: Dourish (2001) - Lecture: Design of embodied learning experiences in CCI (e.g. Schaper et al. (2019) and Schaper and Pares (2021)) - Introduce design brief - Ideation - Plenary discussion
Ideation and prototyping in embodied interaction	- Examine and compare embodied design methods. - Apply ideation and prototyping methods.	- Literature: Wilde, Vallgårda, and Tomico (2017) - Lecture: Embodied design methods (e.g. Landry, Pares, Minsky, and Pares (2012), Márquez Segura, Turmo Vidal, Rostami, and Waern (2016) and Schaper and Pares (2021)) - Exercise: Body Shadow technique (Schaper, Márquez Segura, Malinverni, & Pares, 2023) - Plenary discussion
Presentation 1: Embodied learning experiences	- Plan and develop concepts of embodied prototypes - Analyze appropriateness of embodied learning experiences for children	- Lecture: Evaluation methods for embodied experiences (e.g. Donker and Markopoulos (2002), Malinverni, Schaper, and Pares (2018), Price and Jewitt (2013) and Schaper et al. (2018)) - Presentations: Prototypes - Peer-Feedback - Wrap-up session

4.1. Module Embodied Interaction

The main goal of the module Embodied Interaction (3 lectures/3 h each, see Table 2) was to introduce students to key concepts in embodied interaction and enable them to design an embodied learning experience. Before the first lecture, we invited them to read Dourish's work about the foundations of embodied interaction (Chapter 4: Being-in-the-World: Embodied Interaction) (Dourish, 2001). The literature was then again discussed in class to support students' understanding about the main concepts. Subsequently, the students were introduced to the opportunities for embodied learning experiences for children highlighting related literature in CCI (Antle & Frauenberger, 2020), child development theories (Ackermann, 2004; Piaget, 1955; Vygotsky, 1980) and application examples (Lyons, Slattery, Jimenez, Lopez, & Moher, 2012; Mora-Guiard, Crowell, Pares, & Heaton, 2016; Schaper, Santos, Malinverni, Zerbini Berro, & Pares, 2018; Tscholl, Lindgren, & Johnson, 2013). Further, through the lens of Schaper, Iversen, Malinverni, and Pares's Full-Body Interaction method (Schaper et al., 2019), we showcased challenges in designing embodied interaction experience for children. The method also presented a step-wise procedure to guide the students in the design processes during the following lectures. Finally, the students were introduced to a design brief for their group exercise which was the design of an embodied experience for children that makes them aware of effects of climate change. In addition, they were instructed to the Developmentally Situated Design Cards proposed by Bekker and Antle with the aim to encourage the students to explore children's cognitive, physical, social, and emotional abilities at different age-stages in relation to their design idea (Bekker & Antle, 2011). The rest of the lecture the students worked in teams on their design concept for an embodied experience. Initial ideas were shared and discussed with the entire class.

The goal of the second lecture was to introduce the students to embodied design methods and to provide them opportunities to explore

ideation and prototyping methods during the design process. Before the lecture, we invited the students to read Wilde et al.'s on embodied design ideation methods (Wilde et al., 2017), followed by a plenary discussion in class. Subsequently, the students were introduced to embodied design methods that were specifically useful when working with children (e.g. Landry et al. (2012), Schaper et al. (2019) and Schaper and Pares (2021)) The students were then instructed to use the Body Shadows technique (Schaper & Pares, 2021), a variation of bodystorming based on physical theater practice where the actors use their bodies to create the visual effect of shadow images on a projection wall or a piece of cloth. The technique allows to extend and refine interaction design ideas and to explore opportunities for felt-experiences that can enhance children's learning about a specific concept. For the exercise, a projection screen was set up and the students experimented with their shadows during two iterations. Finally, the students presented their final idea, followed by a plenary discussion about how these ideas could be translated into an embodied experience and the usefulness of the method in their design process.

The goal of the third lecture was present a demo and to conduct a shared evaluation of embodied learning experiences. First, the students were briefly introduced to evaluation methods for embodied interactive experiences in CCI (e.g. Donker and Markopoulos (2002), Malinverni et al. (2018), Price and Jewitt (2013) and Schaper et al. (2018)). Second, the students finalized and set up their prototypes. For the evaluation, the students received a hand-out sheet for peer feedback. The questions were, for instance, *How well did the prototype transmit the design concept of the embodied interactive experience? Is the proposed physical interaction intuitive for children?, How could the prototype be improved?*. Finally, each group presented the concept of their embodied experiences and invited their peers to try the prototypes out. Then two other groups gave peer feedback, followed by comments and a general wrap discussion of the lecturers.

4.2. Module Making and Tinkering

The main goal of the module Making and Tinkering (4 lectures/3 h each, see Table 3) was to introduce students to key concepts about constructionism and provide them with a first experience and reflection on analyzing making and tinkering activities. Before the first lecture, the students were asked to read the article titled "It looks like fun, but are they learning?" by Petrich, Wilkinson, and Bevan (2013), which discusses the evidence of learning in making and tinkering activities constructionist and sociocultural perspectives on learning. The literature was then connected to a hands-on tinkering workshop during the first lecture. In the hands-on workshop, students were introduced to Scratch by making a simple project. The goal of the workshop was to put students "in children's shoes", i.e. offer an opportunity for students to interact with a technology and an activity prompt that was primarily designed for children. The students were told to create an animation of their name, as a way to explore and be familiar with the different coding blocks. Subsequently, the students gathered for a plenary discussion which focused on the instructionist and constructionist aspects of the activity and also the signs of learning based on a framework described in the article students had to read before the class. Finally, the students were introduced to a brief lecture on making and tinkering definitions, history (Papert, 1993), and key contexts of how constructionist and tinkering approaches are used in informal and formal learning, K-12 and higher education.

The goals of the second lecture were to introduce students to the opportunities and challenges of observing and collecting data from making and tinkering activities, understand the process of creating an observation protocol, and create a protocol that aligns with a research question. Before the class, the students read "Digital fabrication and 'making' in education" by Blikstein (0000). Based on the design principles mentioned in the literature, the students were invited to imagine what could be potential obstacles when implementing and observing making activities in educational settings. After the plenary discussion, we showed the students a research project example and asked them what elements could be interesting to observe in the activities that were conducted in the project example. Subsequently, the students were instructed in observation and documentation methods. We offered some research questions related to the hands-on activity of the previous lecture and asked them to create an observation protocol to help answer one of the research questions. Afterward, the students were divided into groups. Half of the class was then instructed to continue their Scratch project from the first lecture while the other half was taking notes using their observation protocol as guidance. After some minutes, the groups switched. Finally, the students shared their observations with the entire class. Based on the feedback, each student group worked on a second iteration of the observation protocol. The lecture closed with reflections on the process.

Table 3
Overview of Module 2 on Making and Tinkering.

Module 2: Making and Tinkering		
Theme	Learning goal	Activity & Literature
Introduction to constructionism	- Identify and describe key principles of constructionism - Relate to technologies designed for children - Analyze making and tinkering activities	- Literature (Petrich et al., 2013) - Lecture: Making & tinkering (Papert, 1993) - Exercise: Scratch - Plenary discussion
Collecting data from making and tinkering activities	- Apply observation & data collection methods in making and tinkering. - Create observation protocol - Create a protocol aligned with a research question	- Lecture: Observation & documentation methods (Blikstein, 0000) - Exercise: Create & test observation protocol 1 - Plenary discussion - Homework: Create Observation protocol 2
Field work in a makerspace	- Apply observation protocol in a real-life setting	- Visit FabLab - Observation exercise
Presentation 2: Observation protocol and results	- Examine and compare robustness of observation protocol - Analyze observations	- Group Presentations - Peer-Feedback - Wrap-up session

Before the third lecture, students were prompted to create an observation protocol for the field trip we were going to do the following week: visiting a public makerspace and observing teachers creating maker activities for their students. Therefore, in the makerspace, students sat around the teachers, and took notes about what the teachers were saying and how they were interacting with each other. The primary plan for this lecture was for the students to observe children in the makerspace. However, after the COVID-19 pandemic, the makerspace implemented restrictions and, for that specific timeframe, was only allowing teachers to use the makerspace.

In the fourth lecture, the students presented their observation protocol and a preliminary analysis of what they had observed during the makerspace workshop. Firstly, the peers gave feedback on students' presentations, then the lecturers, followed by a general wrap-up discussion on the module.

4.3. Module Co-Design with Children

The main goal of the module Co-Design with Children (4 lectures/3 h each, see Table 4) was to enable students to develop co-design methods to involve children in technology design processes and interpret the outcomes. Before the first lecture, the students read the conference publication "Child as Protagonist: Expanding the Role of Children in Participatory Design" by Iversen, Smith, and Dindler (2017). In class, the literature was discussed as an entry point for illustrating different perspectives on children's roles in participatory design processes in the CCI community. Subsequently, the students

Table 4
Overview of Module 3 on Co-design with Children.

Module 3: Co-design with Children		
Theme	Learning goal	Activity & Literature
Co-design with children: theory and practice	- Identify and describe key principles of co-design practices	- Literature: Iversen et al. (2017) and Van Mechelen et al. (2017) - Lecture: Co-design practices in CCI - Introduce design brief
Interpreting & analyzing co-design outcomes	- Analyze co-design outcomes by children - Develop methods to involve children in co-design	- Literature: Van Mechelen, Baykal, Dindler, Eriksson, and Iversen (2020b) and Van Mechelen et al. (2017) - Lecture: Ethics - Group assignment
Co-design session with 4th graders	- Apply co-design in real-life settings with children. - Document and interpret outcomes	- Co-design workshop in school
Presentation 3: Co-design procedure and findings	- Examine and compare co-design with children	- Poster Presentation - Peer-Feedback - Wrap-up session

were introduced to different approaches and rationales of co-design practices with children (Barendregt, Bekker, Börjesson, Eriksson, & Torgersson, 2016; Van Mechelen, Laenen, Zaman, Willems, & Abeele, 2019). Further, through the lens of Van Mechelen et al. Collaborative Design Thinking method (Van Mechelen et al., 2019), the students were instructed to develop a co-design method for a workshop session with children between 10–11 years old. The design challenge was to raise children's awareness about the effects of climate change and enable children to take meaningful climate action. In class, the students worked in teams on a draft of a co-design procedure for the workshop.

The second lecture focused on understanding how to analyze and interpret co-design outcomes produced by children. As an introduction to the topic, the students read (Read, Fitton, & Horton, 2014; Van Mechelen et al., 2017) before class and then compared the literature during a shared discussion. After this exercise, the students were introduced to details of the GLID method (Van Mechelen et al., 2017). With this method, co-design outcomes (i.e., the material product and verbal explanation) are interpreted in a coherent and transparent way by connecting design features to underlying values. In continuation, the students gathered in small groups and discussed the following questions: "Which ethical considerations should be taken into account when involving children in co-design activities? Why?" Students' reflections on the topic were then presented and discussed in a plenary discussion, followed by a brief lecture on ethical considerations (i.e., research, participation, situational and design ethics) when working with children (Van Mechelen et al., 2020b). For the rest of the lecture, the students continued working on their group assignments. After the lecture, they had the opportunity to receive written feedback on their detailed procedure for a co-design session with children.

The third lecture took place in a local primary school. Each student team tested their workshop procedure and methods with a group of 5–6 fourth-grade children. They were also instructed to document the co-design session and to conduct an analysis of the outcomes as homework exercises.

In the fourth lecture, the students presented their findings, showcasing their co-design procedure, lessons learned from the process, and exemplary findings. Then they received feedback from their fellow students, followed by comments and a general wrap-up discussion with the teachers.

5. Results

We report on how we elaborated and iterated the course design based on students' feedback and evaluations. Our reflections are based on students' expectations, midterm evaluation, final evaluation, and self-perceived learning based on post-it notes during the final wrap-up lecture and instructors' observation notes.

5.1. Students' expectations

At the beginning of the course, we inquired the students about their expectations with regard to learning gains and content through an online open-ended questionnaire, followed by a semi-structured plenary discussion. 13 students (m = 11; f = 2) participated. The students reported that they expected to be able to build upon their previous knowledge of theories in HCI and learn how to transfer this knowledge to the design of interactive experiences and products for children. At the same time, they were eager to learn about theories, methods and techniques to involve children in participatory design processes as well as strategies to engage them in technology education. Students' expectations were aligned with our initial plans for the lecture design. We had envisioned introducing them to theories, methods, and techniques in the context of three core themes and extending their knowledge through practice-based experiences in real-life settings. We also took into consideration which related topics in HCI they had been taught in previous courses.

5.2. Midterm evaluation

For the mid-term evaluation, we used an online open-ended questionnaire followed by a semi-structured plenary discussion. 11 students participated in the mid-term evaluation. The students explained that they learned the most when preparing prototypes (e.g. for the embodied interactive experience) and presenting their final projects of each module because it helped them to contextualize the learning contents. Further, they enjoyed the hands-on activities with Scratch that helped them to understand which possibilities the tool can offer children. One student described: "I really enjoyed actually working with Scratch and see what was possible with tools designed for kids. It gave great contextual information, that kind of set up the rest of the module". They also reported that the hands-on activities made them more comfortable working with the tool, and the open discussion dealt with different interpretations and ideas of it. Other students appreciated the opportunity to listen to teachers' "real-life" conversations in the maker space about concrete activities, challenges, and outcomes with children. For example, one student explained: "It was just so useful to hear someone talk about very concrete activities and challenges/outcomes of working with children in this sense. Sometimes when teaching about this topic we might get too far away from the actual context". Further, we observed that the discussions supported students understanding of their learning experiences by encapsulating the complexity and expansiveness of what is possible when working with qualitative research (in CCI) and what outcomes one can acquire.

In contrast, the students explained that they felt that they learned less during the observation protocol exercise due to that they had used similar methods in previous courses. Further, they expressed that exploring exercises such as the shadow exercise felt "childish", "silly" and "uncomfortable", especially since it implied presenting their ideas in a bodily format to their other peers. Moreover, until the second module, children still remained an "intangible concept" for the students since they lacked opportunities for real-life experiences with the target group and "more concrete examples of work with and studying children's interaction with the 'digital'".

In relation to possible improvements for the course, they wished to focus even stronger on practical work in combination with theory. For instance, one student highlighted: "Everything has been fine so far,

both with the embodied experience and the making and tinkering activities we have been doing. The course could be improved if those aspects were taken a step further. For example, if instead of listening to teachers talk about their experiences, we got to both observe children doing the activities, interview the teachers, and maybe apply our knowledge to making our own making and tinkering experience where we would be leading the activity, and the teachers would give feedback on the process after with this ending with a summary of the experience". Further, they suggested that we should anticipate more time to explore the different exercises and to deepen in the theoretical literature that we provided. Some students expressed interest in learning about how children can be empowered in a digital society through learning and creating technology. Instead, students' feedback pointed toward the need for reconsidering the structure of the final presentations of each module. The students particularly highlighted that the presentations were very long and did not give sufficient space for reflection and discussion. Further, the students asked us to strengthen the connections between theories and methods across the three modules.

Based on students' feedback, we discussed the importance of exposing students earlier to experiences with children for further iterations of the course. Initially, this was planned already in the second module, but due to COVID-19 restrictions, we had to make changes to the procedure of the lecture. Moreover, for the third module, we decided to shorten students' presentation time and focus instead more on peer feedback and group discussions.

5.3. Final evaluation

During the final evaluation, we asked the students to fill out the official evaluation questionnaire provided by the university, followed by a plenary discussion during the last lecture. 13 students participated in the final evaluation. Overall, the students expressed their satisfaction with the contents and structure of the course. They also valued the high level of engagement and many hands-on activities throughout the three modules. The hands-on activities allowed the students to connect their theoretical knowledge to real-life situations, e.g. during the co-design workshop with the children from a local primary school. For instance, one student described: "The practical elements and the field excursion (...) have been very insightful. The area of research is very practically oriented, and therefore I felt like I learned the most when we actually tried something (...) both ourselves and (with) the children". Another student explained: "The interactive part of the course has been a good thing. It was great to try out our plan during the workshop with the children and in general doing group exercises with classmates is something I think have worked well". Further, the students also described that they felt learning the most when they prepared presentations or had the opportunity to provide peer feedback.

In relation to the third module, they would have preferred more time to pilot the co-design procedure and perhaps even for a second round. One student mentioned: "We also discussed in a feedback session that a test workshop (possibly just with the fellow students) would make good sense before the final workshop with the children". In addition, the students expressed their hesitation to use photos of the co-design workshops with the children in their presentations based on our introductory lecture about ethics in CCI. In other words, although we had formally acquired consent forms from children's legal tutors, the students were insecure about which photo material was covered by our agreement.

Finally, the students suggested that an overarching theme for the three project-based activities could make it easier for them to understand the connection between the theories and methods across the modules. One student highlighted: "The course has been largely divided into three modules. Although each module as such went well, I feel that there could have been a better red thread through them, e.g. a more comprehensive project across the various modules. Overall, I have sometimes felt that we have constantly jumped from one thing to another". Further, we could observe a shift in students' understanding and appropriation of methods introduced in the course. For instance, after being introduced to embodied design techniques and exploring these themselves, they expressed that they had to "go out of their comfort zone" and that they had difficulties grasping the usefulness of these techniques in the design process. However, several students incorporated embodied design techniques in the co-design workshop activities for the children (module 3). While observing how the children engaged with these methods, they reflected on their usefulness to the specific target group and how the body played an important role in motivating children to take part in design activities.

In the last lecture, we asked the students to write down on post-it notes their main learning gains in each of the modules. Based on these reflections, we discussed potentials and challenges of the themes, methods, and lecture contents. One important learning gain was that the "making and tinkering" and 'co-design with children" modules gave the students different perspectives on how to engage children in design activities. While tinkering activities may need less structure and can be more open-ended, co-design activities require detailed planning before carrying out a workshop with children (e.g. time management, structure, methods, etc.). In this regard, the students discussed the importance of power relations between children and adults in the design process and ways of approaching children in intergenerational projects. Also, they considered the embodiment a key concept across the modules by looking at how children learn through their bodies (e.g. interactive experiences or tinkering activities) and engaging them in co-design processes through playful and bodily-based methods. Further, they reported that it was difficult for them to observe children's behavior during these activities and make sense of their contributions. Finally, the course also gave them a first insight into the age differences in children's cognitive, social, and motor skills and how these differences can influence the activity design in a research project.

6. Discussion

In this case study, we have presented the design and experiences from a recent course in Child–Computer Interaction. Due to the time restrictions of 3 modules of 13 teaching hours each, we did not aim to cover the full spectrum of relevant aspects of CCI (as in e.g. Bekker et al. (2014) and Eriksson et al. (2014)), but rather to evoke interest among students and give them what we call a 'tasting menu' of CCI. So, what is it that a modular tasting menu research-based course can offer compared to e.g. a project-based course in CCI? How can a course built up around the house specialty, that takes advantage of fresh seasonal ingredients, change our way of thinking regarding the way we teach CCI?

Although there are many aspects of this course that can be improved and iterated on (e.g. make objectives visible throughout the course so students understand the bigger picture, improve coordination between lecturers to strengthen the connection between the different modules, etc.), we would like to highlight the promising core principles of our course setup rather than making suggestions for incremental improvements.

A modular approach provides a meaningful alternative to project-based courses, as it allows students to *'taste' different aspects of a field of research* that is rather new to them. Engaging with selected topics that illustrate the essence of CCI research allows students to understand why they should care about CCI and may consider this research field for their future careers. Contrary to tutorials about CCI at conferences (e.g. at CHI) or books (e.g. Hourcade (2015)), which often aim at providing a general overview of CCI research or focus on a specific theme, we seek to awaken interest and onboard the next generation by motivating students to curiously engage with a range of selected and timely topics in the existing body of projects and resources related to children and interaction design currently available at the university.

Further, *bringing in the 'real world' into teaching* through different means (e.g. invited industry talk, visiting a makerspace, conducting co-design activities with school children) allows students to apply and further develop their theoretical knowledge. In this regard, our results illustrate students' challenges and biases when they are confronted with methods for children, that make the students go out of their comfort zone. Thus, it is important to provide students with opportunities to contrast initial expectations and assumptions with 'real-world' experiences where they can test out and observe children's reactions to the methods. Similarly, it is important to transmit to students the value of children's contributions and suggestions for the design process. Particularly, when working with children, adults cannot rely on their own childhood experiences to inform technological designs (Yip et al., 2017). Hence, integrating opportunities for working directly with children in the course is highly recommendable (Eriksson & Torgersson, 2015; Eriksson et al., 2014) to make students aware of children's different understanding of the world and engagement in design processes.

Moreover, ethics is highly important in CCI, however, in the modular course described above, we only had one lecture about this, which obviously is not enough. Also, this introductory lecture to ethics mainly focused on formal ethics, in order to help the students plan their intervention with children and consent forms. However, in the course, we had two encounters with children (makerspace and co-design), and we would like to stress how *students working with children provides a fertile ground for elaborating on ethics in CCI, and especially introducing situational ethics* (Frauenberger, Rauhala, & Fitzpatrick, 2016; Van Mechelen et al., 2020b). Through supervision and practical hands-on experiences, the students were able to identify, practice, and reflect on in-action ethics in a safe space, or what Schön would call a practicum (Schön, 1987), and always receive feedback from supervisors and peers along the way.

Also, teaching *a "tasting menu" of CCI was an efficient way to spend our time and resources*, as each of the teachers focused on their specific research interest, and connected it to their ongoing research focus. This saved time for us in terms of planning, and the backstage work in organizing encounters with children (Bødker, Dindler, & Iversen, 2017; Goffman, 1959). At our university, we benefited from having a strong research group with researchers focusing on different aspects of CCI, which offered a fertile ground for providing students with expert knowledge on multiple themes. These circumstances may not apply to every teaching environment, however, we highly encourage researchers to take advantage of their expertise and "insider" knowledge in CCI research and to connect these to their teaching practices.

Finally, in terms of *onboarding new talent* in CCI, we cannot yet say so much about this, since the students have not yet chosen a career path. However, we have experienced some students interested in continuing to design with and for children as a topic in their master thesis, so we can see that a seed has been planted to some extent. Our focus of the course was on supporting students' understanding of specific characteristics of CCI research and why they should take into account working in this field for their future careers. This does not necessarily mean that the aim is for all of them to become CCI researchers, but rather have an awareness of the field and equip them with some practice from working with interaction design and children, which will strengthen them in their future careers, in academia or industry.

7. Conclusion

The main objective of this paper is to serve as an inspiration for others who intend to teach CCI, but may not have the capacity to cover the whole field, and who seek to awaken an interest in students. Further, we seek to inspire CCI researchers on ways to create research-based teaching. However, this is also a call for the CCI community, in general, to share teaching experiences and engage in discussions around the ever-evolving CCI curriculum. Thereby, it is also an urge for the IJCCI journal to dedicate a section in each issue to case studies of teaching CCI in order to support the development of the community — not just in research but also in teaching for onboarding new talent in CCI.

CRediT authorship contribution statement

Marie-Monique Schaper: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Mariana Aki Tamashiro:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Maarten Van Mechelen:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Ole Sejer Iversen:** Supervision, Writing – review & editing, Conceptualization, Methodology. **Eva Eriksson:** Conceptualization, Methodology, Validation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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Selection and participation of children

This case study was conducted in the context of an elective master course on Child–Computer Interaction with 13 students (m = 11; f = 2). We assessed students' expectations, evaluation of the course, self-perceived learning and researchers' field notes. The final results were summarized in a report and shared with the students who had the opportunity to provide further feedback and correct researchers' interpretation of their feedback. A student representative approved the final version behalf of the entire course.

Children from a local primary school were involved in a co-design workshop with the students. Before the activity, the students were instructed about ethical aspects when working for children. Further, the responsible teacher sent the project information and the informed consent to legal tutors. In the consent forms we asked both the legal tutors and the students for their agreement on data collection and dissemination. The parents were also invited to contact our research team for further information.

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