The User Experience Design Program: Applying Situated and Embodied Cognition Together With Reflective Teaching

Beatrice Alenljung*, Kajsa Nalin and Jana Rambusch

Interaction Lab, Division of Computer and System Sciences, School of Informatics, University of Skövde, Skövde, Sweden

The education of students to become competent user experience designers is a delicate matter as students need to obtain a multitude of knowledge, skills, and judgmental abilities. In this paper, our effort to manage this multiplicity in a bachelor's program in user experience design is shared along with our experiences and teaching practices influenced by theories of situated and embodied cognition together with reflective teaching. The program was followed up through interviews with eight alumni and a company representative that employs user experience designers. The results show that the program overall works well, although some of the identified issues need to be addressed in the future. The interpretation is that our program curricula and teaching practices are fruitful, which hopefully can contribute to thoughts and discussions for other teachers in the field of user experience design and human-computer interaction.

Keywords: situated cognition, embodied cognition, reflective teaching, user experience design, higher education, human-computer interaction

INTRODUCTION

User experience (UX) designers need a wide range of knowledge, skills and judgmental abilities to be successful, for instance, knowledge about the user experience design (UXD) process and various UX methods and techniques, skills to perform investigations, evaluations, data analyses, along with how to stimulate creativity and innovation, and judgmental abilities to make ethical and societal considerations.[1] The issue of what an educational curricula for human-computer interaction (HCI) and UXD should embrace have comprehensively been in focus and discussed for many years not least by the SIGCHI education project (SIGCHI, 2014), the living HCI curriculum initiative (Churchill et al., 2013, 2014, 2016), and in workshops all over the globe (e.g., Peters et al., 2016; St-Cyr et al., 2019; MacDonald et al., 2021). It is clear that a program in UXD requires balancing multiple learning objectives; preparing future UX designers for a professional career as well as augmenting students' ability to pursue advanced level and graduate studies, which is discussed by, for example, Peer (2017).

---

[1] The occupational title UX designer is used in this paper, which reflects the name of the presented program and the type of work we prepare the students for. We are aware that UX designer is an industrial label and we acknowledge that the field of human-computer interaction is the academic realm of the program.

A wide range of work have been conducted in the community of HCI and UXD education. Some address pedagogical challenges on a course level (e.g., Karahasanović and Culén, 2021; Slavina and Gilbert, 2021), others focus on aspects related to the student population (e.g., Hui, 2020; Wong-Villacres et al., 2020), and some investigate the education landscape (e.g., Burgar, 2017; Khademi and Hui, 2020).

This paper contributes to the body of knowledge of education in HCI and UXD by sharing and reflecting on a 3-year UXD bachelor's program, offered at the University of Skövde in Sweden, regarding our efforts to address and balance multiple learning objectives. The purpose is to provide other teachers in the field inspiration and fuel for thoughts and discussions. In our case, the program curriculum and teaching practices are, in particular, influenced by situated and embodied cognition as well as reflective teaching (described in Section Theoretical Perspectives and Pedagogical Principles), which is an effect of the cognitive science origin of the program and the related research group's theoretical specialization in situated and embodied cognition (learning environment is explained in Section Learning Environment). In line with reflective teaching practice, we have followed up the program design by interviewing alumni and a company representative that employ UX designers (reported in Section Follow-Up). Based on this, practical implications and lessons learned are discussed (see Section Practical Implications and Lessons Learned).

THEORETICAL PERSPECTIVES AND PEDAGOGICAL PRINCIPLES

Situated and Embodied Cognition

Theories of situated and embodied cognition, as discussed and positioned in the cognitive science area, are not universally agreed upon and vary in content and specifics; however, they usually share an emphasis on the role of the body in cognition as well as the material and social-cultural setting or context in which an activity is carried out (Shapiro, 2014; Newen et al., 2018). Moreover, emphasis is placed on the interaction between brain, body, and the material and social environment where cognition is seen as something more than what happens inside the brain, in contrast to cognitivist theories on human cognition. Importantly, situated and embodied cognition should not simply be viewed as a specific type of human cognition that can be separated from non-situated and non-embodied cognition. Rather, it is a theoretical position that seeks to understand the very nature of human cognition.

Theories of situated and embodied cognition have led to an overall rethinking of learning theories and educational practices and research as well. There are a variety of perspectives and viewpoints on the issues of situated learning and knowledge appropriation, as researchers interested in the complexities of learning and human cognition have been active in a wide range of research fields (Lave and Wenger, 1991; Sawyer and Greeno, 2009; Yeoman and Wilson, 2019). Focus has often been on children's learning in school and community settings, and less on adult education in comparison; the focus here is on adults in a

higher education setting (cf. e.g., Chiou, 2020). However, despite differences in approaches and foci, a common theme is that social interactions with other individuals and the active use of external structures in the environment are considered an important part of situated learning activities.

The social-cultural dimension frequently emphasized in situated perspectives on learning is drawing on a diverse range of historical ways of learning and teaching such as craft and trade apprenticeships. Lave and Wenger (1991) is one of the seminal sources for understanding the situated nature of learning, and as they point out, learning and work practice are indivisible from each other and the use of different kinds of apprenticeship reveal the distributed, social nature of learning and knowledge; i.e., concepts of apprenticeship capture how people, in communities of practice, learn by means of participation and guidance. From this perspective, successful learning activities occur in the context of real life, and should be reflected in the curriculum in educational settings.

An important characteristic of learning through participation and guidance is the use of tools; we humans are very proficient in using environmental properties as cognitive aids, such as note taking with pen and paper, and the last 20+ years have shown a substantial interest in finding out how different tools affect cognition and learning (e.g., Hutchins, 1995, a well-known and highly regarded book on this topic). There is also an important social dimension to tool use; even seemingly individual actions are social in nature where much of the interaction is indirect and mediated via different tools (Hutchins, 1995). Furthermore, other people, and their knowledge and experience can also be seen as social tools, which brings us back to the concept of apprenticeship and how people learn through guidance by others with more in-depth knowledge and skills (Susi, 2006). There is also an embodied dimension to learning activities as social exchange and tool use as embodied activities appear to be a necessary precursor condition for all forms of mental activity (Rambusch and Ziemke, 2005); for instance, the body appears to serve an important role in developing and understanding abstract concepts and knowledge (e.g., Kita et al., 2017), and also appears to facilitate creative work (e.g., Baber et al., 2019).

Reflective Thinking and Teaching

Our teaching practices are also characterized by reflective thinking and teaching, one of many pedagogical approaches in higher education, which concerns the practice of evaluating pedagogical experiences in systematic ways as a means to further develop future teaching (Ashwin et al., 2015). There are three personal characteristics in relation to reflective thinking; open mindedness, wholeheartedness, and responsibility (Dewey, 1933). A reflective thinker is an active, curious and critical listener, committed to the task at hand, and has to consider the consequences of a planned action. Thus, reflective thinking can be used to evaluate current beliefs and shed new light upon past experiences, which is essential in a higher education context. It requires continuous analyzes and evaluation of teaching practices to understand what is happening within the system in which the work is carried out (Ashwin et al., 2015).
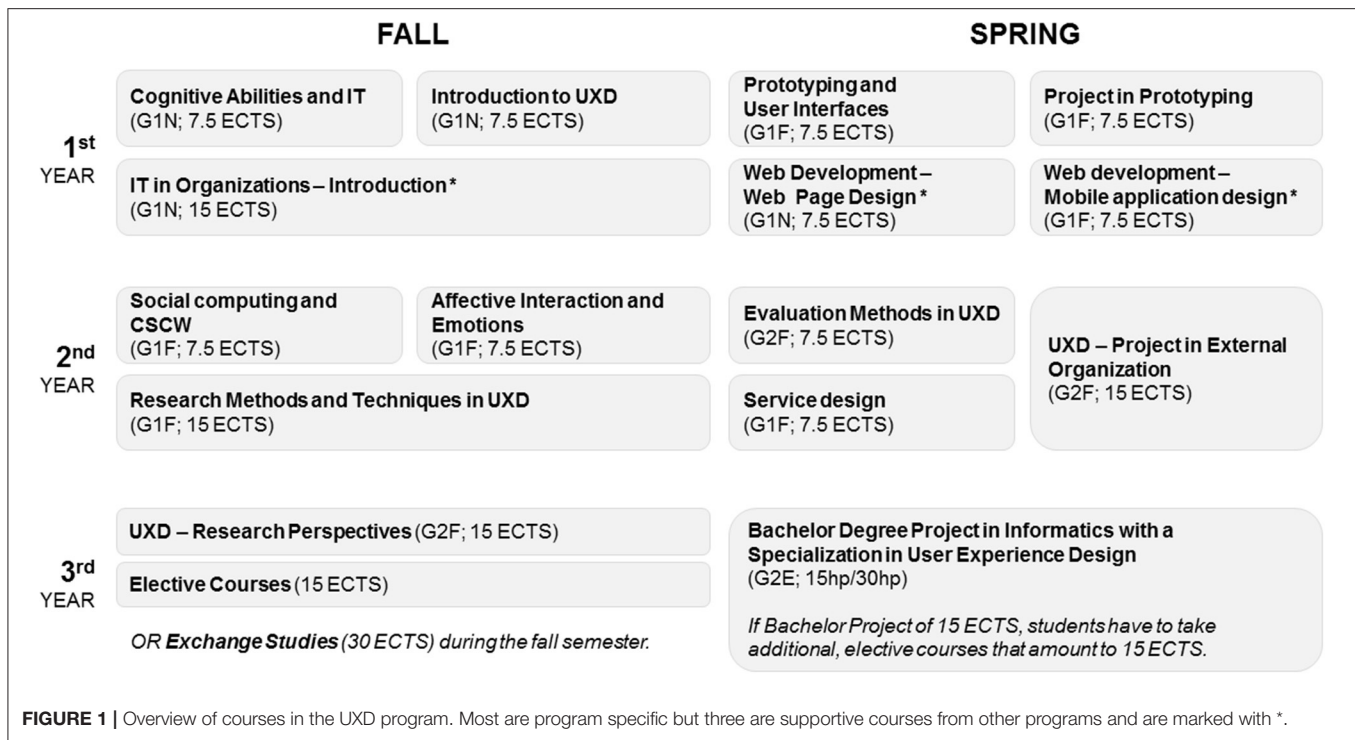
FIGURE 1 | Overview of courses in the UXD program. Most are program specific but three are supportive courses from other programs and are marked with *.

An important aspect of reflective teaching practices is the situatedness in time and in space, that is, they cannot be separated from the context in which they occur. Another facet of this context dependency is that reflective teaching practices are relational, i.e., relations are always involved in teaching, and the practices ought to focus on particular instances of relational interaction rather than general occurrences of transferring knowledge from sender to receiver(s). Therefore, teaching practices can be seen as interactions being both relational and situated, making mere routine teaching a problematic path to pursue as different people emphasize different aspects in their teaching, depending on their own background and interests as well as in relation to the students' various needs and learning preferences. In order to avoid this, constant and iterative questionings of everyday assumptions are needed.

LEARNING ENVIRONMENT

The UXD program is offered at the School of Informatics at University of Skövde in Sweden, leading to a degree of Bachelor of Science in informatics, 180 ECTS credits in total; 135 ECTS credits UXD specific courses including a required degree project of at least 15 ECTS credits, 30 ECTS credits supportive courses, and 15 ECTS credits elective courses (see **Figure 1**). ECTS stands for European Credit Transfer and Accumulation System, which is used as a tool in the higher education area of Europe to make students' academic qualifications comparable. Sixty ECTS credits equals a full year of study (European Commission).

The program started in 2013, replacing the Cognitive Science program (1993–2015), which specialized in human-computer interaction (HCI). Thus, the current UXD program is founded on a long educational tradition of Cognitive Science and HCI. Many of the lecturers are active researchers in and advocates of embodied and situated views on human cognition, which is why those theories constitutes a natural pedagogical basic view. Courses are given by a team of 14 lecturers, six male and eight female; the majority of them hold doctor of philosophy (PhD) degrees (eight persons of which one is associate professor). Each year, about 33 new students are enrolled (ca. 60% male, 40% female) and about 15 students pass the final year project (gender distribution approximately the same as the first-year students). Students dropping out before completing their education is a common issue for many undergraduate programs at the university, and reasons vary from student to student; some leave because of family or health issues, others lack a clear direction or change disciplines, and then we have students struggling financially or academically. It is not uncommon though for students who struggle academically to complete their studies at a slower pace.

Learning Objectives

As an educational program in Swedish higher education, the program curriculum is required to cover three categories of learning objectives specified in The Higher Education Ordinance (1993, p. 10) of Sweden: *knowledge and understanding*; *competence and skills*; and *judgement and approach*. These categories concern different aspects of education and both the theoretical and practical training included in these are addressed in the overall design of the UXD program. Each year, the primary objectives for the past year is summarized in a project course,

allowing students to synthesize, demonstrate, and apply their knowledge and skills achieved so far.

Knowledge and Understanding

An important study objective in the **first year** is students' expressed knowledge and understanding of UXD basics and human cognition, and how UXD fits into a broader organizational context. Students also learn how to apply their knowledge in a practical UX setting, using essential concepts of user-centered design, such as user research, conceptual design, prototyping, and evaluation.

In the **second year**, one of the main objectives is for students to obtain theoretical knowledge relevant for UXD both as a vocational and an academic field, including social cognition and social interaction, situated and embodied cognition, as well as affective interaction design and emotion theories.

The **third year** provides a scientific outlook in terms of both historical background as well as current and future grand challenges in the field.

Competence and Skills

After the **first year**, the students should, in addition to theoretical knowledge and understanding, have necessary practical skills to do real UX work. Also, students should reach basic general academic competence and skills, primarily academic writing, reference management, oral presentations, and cooperating with others. The first-year assignments are mainly carried out as group work. The first-year wrapping up-project is done in house or in cooperation with smaller local companies and provides a clear timeframe within which specific and beforehand introduced milestones have to be met.

The **second-year** purpose is that the students should achieve UXD relevant methodological competence in a both vocational and academic sense, such as planning and carrying out empirical (research) studies as well as various forms of evaluations (e.g., cognitive walkthrough and UX testing). Students are, for instance, expected to take on more personal responsibility toward learning and independencies, and assignments are conducted in a mixture of individual work and teamwork. The second year ends with a project done in collaboration with an external organization acting as the students' client.

In the **third year**, the students work almost solely on their own and are to a large extent driving their own learning process. They are expected to identify research gaps and generate original research questions through problematization. The education ends with a degree project that most students do individually throughout the whole semester.

Judgment and Approach

During the **first year**, students are introduced to various reflective and self-reflective exercises and assignments, to cogitate upon their learning, and to spur new insights, such as that there seldom is only one right answer to a problem since human cognition and interactions with digital products are affected by a variety of factors, e.g., an activity's social and cultural context. The students are encouraged to go beyond their own point of views and assumptions, for instance, to take the user's perspective in

the design process. A first introduction to ethical and societal considerations is also made.

Throughout the **second year**, reflection and self-reflection continues with an increased attention to the situated and embodied perspective on cognition, as well as ethical and societal considerations. The students are asked to consider, e.g., the influence of social media on social interactions and how information technology can aid or hinder cooperative work.

The objective of the **third year** is that the student should mature into an independent academic that is able to make well-thought through ethical and societal considerations and view their pursuits in a scientific context. The student should be able to put different aspects in relation and perspective.

Situated and Embodied Teaching Practices

The teaching practices borrow many cues from the concept of apprenticeship by providing students opportunities to explore and develop essential skills in real case scenarios. A scenario can be limited to an individual, minor assignment or span a whole course during which students work toward reaching specific milestones and goals. The students are guided and instructed, but the levels of lecturer involvement and student participation change over the years. In the first year, clear goals are set, detailed instructions are given and the students are made sure to stay within safe boundaries of potential answers and solutions to a problem. During the latter half of the second year, students are encouraged to set their own sub-goals and milestones toward an expected outcome (which can vary depending on the chosen path by the students). There is still a lot of guidance but the students are expected to increase individual and group responsibility during lectures, seminars, and supervision. In the third and final year, students take on an even more active and leading role in various learning situations whereas the lecturers mainly make sure discussions stay productive and on topic within the given guidelines, and provide feedback and suggestions during the final year project.

It follows from the apprenticeship concept that students also are provided opportunities to develop necessary skills in realistic settings, for instance, in the context of UX tests in the university's lab environment, or in cooperation with an external company where students meet company representatives who can act both as client and as a coach. Furthermore, it is important that the students not only read about various theories and concepts but that they also get the chance to grasp their inherent meaning. A key practice is therefore to let students participate in practical, hands-on exercises, activities, and assignments to let them experience what it is like, among other things, to interview user target groups, identify suitable UX goals based on the interview results, and see how difficult it is not to get lost in design details early in the process. Students also work with sketching, prototyping and basic HTML/CSS (which stands for HyperText Markup Language and Cascading Style Sheets that are used in web page design), individually and in groups; important tools are pen and paper, various crafting supplies, and various digital tools for prototyping and web design. To explore and understand the more theoretical concepts of, for instance, situated and embodied cognition, students are required to discuss and explain concepts

and theories through real usage situations. Affective values in interaction design and their impact on the UX are explored, e.g., through object manipulation; students create a small set of objects that they must modify or design with various materials in mind, to change the object's affective features.

Reflective Thinking and Teaching

Reflection in terms of frequent evaluations and assessment is standard practice as evaluation of ongoing and past occurrences is essential in ensuring future events do not lead to loss of quality or direction.

On a program level, there are two types of formal program evaluations; one is performed once a year and one is carried out every sixth year. There are also informal follow-ups where feedback from students is given in dialogue with the program coordinator in program meetings once or twice per semester. In addition, there is a program council consisting of three UX designers with several years working experience in several companies. The program coordinator meets the council every 2 or 3 years, ensuring the curriculum is relevant and current, and comply with the needs of the UX community.

On a course level, formal questionnaire-based evaluations are conducted, which are automatically distributed to the students after a course ends. Course coordinators are required to reflect upon the evaluation results, including ratings and free text comments, in relation to the course's pre-defined learning objectives, and to provide suggestions for improvement. Course evaluations are primarily used for future course development, but, to some extent, they can also be used to ensure the expected course progression within the program.

On an everyday basis, many lecturers have developed a practice of addressing and discussing concerns regarding aspects that can be improved in future course editions, for instance, when lecturers receive repeated questions about the course curriculum or assignment instructions, or when students have difficulties achieving a certain learning objective associated with an assignment or exam. Having a dedicated space in the university's learning management system is one example of how lecturers keep track of suggested improvements.

FOLLOW-UP

Data Collection and Analysis

In order to get insight on how well the UXD program prepares the students for a working life as a UX designer a qualitative interview-based follow-up study with eight alumni and one company representative with experiences in recruiting UX designers was conducted.

The recruitment of interviewees was primarily intended to be made via a posting in the program's LinkedIn alumni group. However, only one of the alumni interviewees was recruited this way, due to lack of responses. The other seven participants were directly contacted by the program coordinator via email. The company representative was contacted by email as well. Four alumni were male, four female, as was the company representative. All but one alumnus work as UX designer.

Graduation year for the alumni was one from each year 2016–2021, except 2020 when three alumni graduated. The emails scheduling the interview appointments contained information about the purpose and format of the interview, and that data was to be treated confidential.

The interviews were conducted individually and consisted of open-ended questions. The questions in the alumni interview guide covered participants' description of their tasks at work, to what extent and in what ways the program made them prepared or not for the job, and what they think should be added, removed, and kept in the program. Example *"If you think about the methods and practical experiences you gained from the program, what do you think about them in relation to your current work?"* The interview guide for the company representative followed the same structure, but was phrased in a slightly different manner, i.e., what competences and skills they expect from a newly graduated UX designer. Example: *"To what extent do you think a UX designer needs to know different methods and have practical experience? What kind of methods? What kind of practical experience?"*

Each interview began with informing the interviewees once more of the purpose, confidentiality, and what the results will be used for. Then they were asked for permission to record the interview to which all approved. A semi-structured interview guide was used. All questions were open-ended and a conversational interview style was established. All interviews were conducted via Zoom, and each lasted for about half an hour. All interviews were subsequently transcribed.

The data analysis started with coding of the alumni transcripts with predefined coding categories on two levels. The top-level categories were (a) knowledge and understanding, (b) competence and skills, (c) judgment and approach, and (d) others. The sub-level categories were (a) expressions of satisfaction, (b) expressions of dissatisfaction, and (c) neutral utterances. All quotations for a certain category were collected into separate topic memos, within which an inductive analysis was conducted where patterns emerged and were formed into a result. Thereafter the data in the company representative transcript was summarized.

Viewpoints From Alumni and Company Representative

The alumni's overall view of the UXD program is that they are satisfied with it and that it made them prepared for a working life as a UX designer, but that there are aspects that need improvement.

Knowledge and Understanding

The alumni are pleased with having a solid understanding of UXD as a whole; the design process and basic concepts such as UX, usability, interaction and communication. They also find their knowledge of organizations and systems thinking valuable in their work. The program contains a breadth of related topics, e.g., social computing, that creates a wider beneficial understanding, even though they are not currently specifically working with them. Furthermore, they find their basic knowledge and understanding of cognitive abilities and related

principles for design of user interfaces useful, not only for design tasks, but also as basis for explanations and arguments with, e.g., developers. Having fundamentals in programming is also of importance.

There is also knowledge that the alumni consider was lacking from their education, making them less prepared for their work. They miss content on how to handle the integration between agile development and the UX design process, how to work with UX in UX immature organizations, the handover phase between UX design and realization, as well as circular design. Moreover, the alumni regard it to be useful with a more in-depth knowledge and understanding of systems thinking, technical aspects, the stakeholder perspective as a complement to the user perspective, as well as different kinds of values, such as, business, customer, and societal value.

Furthermore, there was content that they found superfluous, in particular, affective computing and emotion theories, but also social computing and human-robot interaction.

The company representative emphasizes that a newly graduated UX designer is required to have deep knowledge and understanding of all the three fundamental parts of the UX design cycle: user research, design, and evaluation. The UX designer is also expected to have theoretical knowledge of human cognition and social psychology.

Competence and Skills

The alumni point out a range of competence and skills they obtained as students that are useful in their daily working life. They experience themselves as confident and comfortable in doing investigations, data collection as well as data analysis, with help of quantitative and qualitative research methods. Conducting UX evaluations, analytical and empirical, are also within their comfort zone. They are competent in sketching and using prototyping tools to conceptualize and do mock-ups. The alumni have basic front-end skills and can themselves manage design elements.

They have also obtained general skills that are valuable on a daily basis. The alumni find themselves to be well-trained to argue for their cause, motivate their suggestions, and convey their opinions. They possess the ability to work in groups, such as to cooperate and communicate, to "give and take", as well as understand and meet the expectations of others. The alumni are able to specify problems, have the capability to go between whole and detail, and know how to find trustworthy sources of information. They are skilled in leading workshops and make presentations.

There are also competence and skills that the alumni considered should have been part of the program. Missing are project management including better understanding of different roles in an information technology project through experience of working in multi-professional teams, capability to handle the transition between the design process and the realization phase, how to manage and change UX work in UX immature organizations, as well as how to involve multiple stakeholders. The alumni thought that more skill training is needed regarding how to conduct workshops, prototyping and prototyping tools with less need for sketching techniques, to perform convincing

presentations and argumentations, programming, and how to manage statistical methods for user data.

In addition, the alumni call for more practical experience in general and that the ability to build a portfolio could be improved. Another issue that was raised was that there is too little individual work, which can cause a lack of experience in relying on oneself to carry out UX tasks. Sometimes as a professional UX designer you have no other UX designers to collaborate with.

The company representative stressed that a recently graduated UX designer should be able to "bridge" the whole process, i.e., transform data into needs and requirements and attain a design based upon that so that the design is not freestanding. The UX designer is expected to have the ability to justify their work suggestions and design proposals, which is vital to achieve credibility. Furthermore, he/she is anticipated to have the competence and skills to conduct user research and UX evaluations, which also includes insights regarding bias. The ability to consider bias is an important example of competence that separates someone with an academic background from an autodidact person. The company representative also highlighted that in the future the UX designer should have competence to do data-driven analysis, e.g., Google analytics.

Judgment and Approach

The alumni have awareness of ethical and societal aspects that they have obtained from the program, such as, accessibility for all, data privacy issues, and that badly designed systems can create a poor working environment. They mentioned that there are ethical dilemmas that need to be considered. There was a call for more focus on accessibility for all. The company representative argued that as a UX designer, you need to be a "thinker" and not just a "doer", where, e.g., the ethical perspective and accessibility for all is important. This is not easy for someone who is a junior, but if this is included well in the education, the new UX designer can feel more confident in questioning, according to the company representative.

The alumni view themselves as self-reflective and having awareness of the need to continue to develop and learn. The program increased their ability to receive feedback from others. However, the downside of self-reflection is that it creates uncertainty and doubt about one's own ability. The company representative claimed that self-reflection is important and a natural part of the work and the UX designer role. An overview of the findings in the follow-up is presented in **Table 1**.

PRACTICAL IMPLICATIONS AND LESSONS LEARNED

Learning objectives in terms of *knowledge and understanding*, *competence and skills*, and *judgement and approach* are satisfactorily met throughout the program and, of course, the line between these three categories is an artificial one as they are closely linked to each other. The results show that students are well-prepared to work as UX designers and that the program mostly strikes the right balance between preparing students for practical UX work and augmenting students'

TABLE 1 | Overview of findings in the follow-up.

	KEEP	ADD	REMOVE
Knowledge and understanding	- UXD process - Basic concepts, e.g., UX, usability, interaction - Cognitive psychology and related user interface design principle - Organization theory - Systems thinking - Fundamentals in programming - Breadth of topics, e.g., social computing	- Integration between agile development and UXD - Working with UX in UX immature organizations - The handover phase between UX design and realization - Circular design - More systems thinking - More technical aspects - The stakeholder perspective - Business, customer, and societal value	- Affective computing - Emotion theories - Human-robot interaction
Competence and skills	- Qualitative data collection and analysis - Quantitative data collection and analysis - Empirical and analytical UX evaluation - Sketching and prototyping - Front-end skills - Argue and motivate - Group work - Problem specification - Move between whole and detail - Find trustworthy sources of information - Lead workshops - Make presentations	- Project management - Working in multi-professional teams - Handle transition between the design process and realization - Manage and change UX work in UX immature organizations - Involve multiple stakeholders - More training in conducting workshops - More prototyping tools - More argumentation and presentation - More programming - More statistical methods for user data - More practical experience in general - Ability to build portfolio - More individual work with UX tasks	- Less sketching
Judgment and approach	- Ethical and societal aspects, e.g., accessibility, data privacy, effects on working environment - Be a "thinker" not just a "doer" - Self-reflectiveness - Awareness of the need to continue to develop and learn - Ability to receive feedback	- More accessibility for all	- Uncertainty and doubt of one's own ability caused by continuous self-reflection

academic achievements. The results are encouraging since a lot of our teaching practices draw inspiration from theories about the situated and embodied nature of human cognition and learning, which heavily emphasize the importance of guidance, participation and the use of external aids in learning activities. However, situated learning theories still mostly fail to address how socio-cultural processes transform into mental processes. Conceptions of apprenticeship and (guided) participation are largely based on ethnographic studies of learning and everyday activities which have repeatedly demonstrated how different schooling is from daily activities where those daily activities themselves give meaning and purpose to what is learned. This is one of the reasons why we take great care to situate various exercises and assignments in realistic, work-like settings. Reflective teaching is also a main thread running through our teaching practices as it calls for reflection and a focus on continually strengthening the various learning objectives. The reflective part is also something that has spilled over onto students' learning activities as students repeatedly are required to reflect on their own learning and achievements, a necessary skill for a UX designer, as highlighted by the company representative in the interview.

However, it was no surprise that the alumni interviews revealed potential areas of improvements too. One of the main critiques was the program's considerable focus on UX, which complicated students fitting in and finding their place in project teams with people having varying vocational and academic backgrounds; they know very little about taking the step from design to implementation. This is something we have been discussing and one suggestion is replacing the elective courses in the third year with a project course where students from various programs in informatics can meet and collaborate, thereby covering many of the various vocational roles and steps involved in a development project. Another critique addressed how the students are relatively unprepared for the varying level of UX maturity in companies and organizations, unless they choose to focus on this particular topic in their bachelor's project. From this perspective, the program content represents an idealized point of view, how UXD "should be" rather than how it often turns out to be. It is a dilemma; on the one hand the students need to learn how it should be done for them to be able to inspire changes at an organizational level, on the other hand they ought to be prepared for whatever UX-related challenges that lie ahead. In this case, we settle for making students aware of challenges ahead rather than

training them to handle these challenges. We will do this by re-balancing course content, high-lighting such challenges as part of for example ethical and societal considerations.

To conclude, to provide an education in which students can obtain knowledge, skills and judgmental abilities to become a well-prepared and attractive UX designer is not an easy endeavor. In this paper, we share our efforts concerning managing a multitude of learning objectives and our experiences and teaching practices that are influenced by situated and embodied cognition together with reflective teaching. Our interpretation based on the follow-up with alumni and a company representative employing UX designers is that our path is fruitful, both in terms of program curriculum, the pedagogical influences, and that doing this kind of follow-up gives valuable insights for improvements. Hopefully, this can contribute with inspiration and provide input for thoughts and discussions for others working with education in UXD and HCI.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the data consist of interview transcripts, where there is a risk – although very small – that it can be traced back to an individual. Requests to access the datasets should be directed to beatrice.alenljung@his.se.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ACKNOWLEDGMENTS

REFERENCES

Ashwin, P., Boud, D., Calkins, S., Coate, K., Hallett, F., Light, G., et al. (2015). *Reflective Teaching in Higher Education*. London: Bloomsbury Academic.

Baber, C., Chemero, T., and Hall, J. (2019). What the jeweller's hand tells the jeweller's brain: tool use, creativity and embodied cognition. *Philos. Technol.* 32, 283–302. doi: 10.1007/s13347-017-0292-0

Burgar, V. (2017). *HCI and UX Design Education*. Available online at: https://www.researchgate.net/profile/Vanessa-Burgar/publication/338121833_HCI_and_UX_Design_Education/links/5e00cd89a6fdcc28373954ad/HCI-and-UX-Design-Education.pdf (accessed December 8, 2021).

Chiou, H.-H. (2020). The impact of situated learning activities on technology university students' learning outcome. *Educ. + Train.* 63, 440–452. doi: 10.1108/ET-04-2018-0092

Churchill, E. F., Bowser, A., and Preece, J. (2013). Teaching and learning human-computer interaction. *Interactions* 20, 44–53. doi: 10.1145/2427076.2427086

Churchill, E. F., Bowser, A., and Preece, J. (2016). The future of HCI education: a flexible, global, living curriculum. *Interactions* 23, 70–73. doi: 10.1145/2888574

Churchill, E. F., Preece, J., and Bowser, A. (2014). "Developing a living HCI curriculum to support a global community," in *Proceedings of the Extended Abstracts of the 32nd Annual ACM Conference on Human Factors in Computing Systems CHI EA'14* (New York, NY: ACM Press), 135–138.

Dewey, J. (1933). *A Restatement of the Relation of Reflective Thinking to the Educative Process*. Boston, MA: DC Heath.

European Commission. *European Credit Transfer and Accumulation System (ECTS)*. Available online at: https://ec.europa.eu/education/resources-and-tools/european-credit-transfer-and-accumulation-system-ects_en (accessed December 8, 2021).

Hui, B. (2020). "Lessons from teaching HCI for a diverse student population," in *Koli Calling'20: Proceedings of the 20th Koli Calling International Conference on Computing Education Research (Koli Calling '20), November 19–22, 2020, Koli, Finland, Finland* (New York, NY: ACM), 5.

Hutchins, E. (1995). *Cognition in the Wild*. Cambridge, MA: MIT Press.

Karahasanović, A., and Culén, A. L. (2021). "A service-dominant logic based framework for teaching innovation in HCI," in *Proceedings of the International Conferences on Interfaces and Human-Computer Interaction and Game and Entertainment Technologies 2021*, 17–25. Available online at: http://urn.nb.no/URN:NBN:no-91980 (accessed December 8, 2021).

Khademi, K., and Hui, B. (2020). "Towards understanding the HCI education landscape," in *Koli Calling '20: Proceedings of the 20th Koli Calling International Conference on Computing Education Research (Koli Calling '20)* (New York, NY: Association for Computing Machinery), 1–2.

Kita, S., Alibali, M. W., and Chu, M. (2017). How do gestures influence thinking and speaking? The gesture-for-conceptualization hypothesis. *Psychol Rev.* 124, 245–266. doi: 10.1037/rev0000059

Lave, J., and Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge, MA: Cambridge University Press.

MacDonald, C. M., St-Cyr, O., Gray, C. M., Potter, L. E., Sin, J., Vasilchenko, A., et al. (2021). "EduCHI 2021: 3rd annual symposium on HCI education," in *CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI '21 Extended Abstracts), May 08–13, 2021* (Yokohama; New York, NY: ACM), 4.

Newen, A., De Bruin, L., and Gallagher, S. (2018). "4E cognition: Historical roots, key concepts, and central issues," in *The Oxford Handbook of 4E Cognition*, eds A. Newen, L. De Brun, and S. Gallagher (Croydon: Oxford University Press), 2–16.

Peer, A. (2017). The future of user experience education. *Interactions* 24, 66–69. doi: 10.1145/3095710

Peters, A., Jordan, Z., Merkle, L., Rocha, M. M., Nocera, J. A., van der Veer, G. C., et al. (2016). "Teaching HCI: a living curriculum?," in *Proceedings of the First African Conference on Human Computer Interaction (AfriCHI'16)*. New York, NY: Association for Computing Machinery, 267–270.

Rambusch, J., and Ziemke, T. (2005). "The role of embodiment in situated learning," in *Proceedings of the 27th Annual Conference of the Cognitive Science Society*, eds B.G. Bara, L. Barsalou, and M. Bucciarelli (Mahwah, NJ: Lawrence Erlbaum), 1803–1808.

Sawyer, R. K., and Greeno, J. G. (2009). "Situativity and learning," in *The Cambridge Handbook of Situated Cognition*, eds P. Robbins, and M. Aydede (Cambridge, MA: Cambridge University Press), 347–367.

Shapiro, L. A. (ed.) (2014). *The Routledge Handbook of Embodied Cognition*. New York, NY: Routledge.

SIGCHI (2014). *2011-2014 Education Project. ACM Special Interest Group on Computer-Human Interaction (SIGCHI)*. Available online at: https://sigchi.org/2017/01/2011-2014-education-project/ (accessed December 8, 2021).

Slavina, A., and Gilbert, S. B. (2021). "Perspectives in HCI: a course integrating diverse viewpoints," in *3rd Annual Symposium on HCI Education EduCHI 2021, Saturday 15 May*. Virtual.

St-Cyr, O., MacDonald, C. M., and Churchill, E. F. (2019). "EduCHI 2019 symposium," in *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems* (New York, NY: ACM), 1–7.

Susi, T. (2006). *The Puzzle of Social Activity - The Significance of Tools in Cognition and Cooperation* (doctoral dissertation). University of Linköping, Linköping.

The Higher Education Ordinance (1993). *Ministry of Education and Research, Sweden*, 10. Available online at: https://www.uhr.se/en/start/laws-and-re gulations/Laws-and-regulations/The-Higher-Education-Ordinance/ (accessed December 14, 2021).

Wong-Villacres, M., Garcia, A. A., and Tibau, J. (2020). "Reflections from the classroom and beyond: imagining a decolonized HCI education," in *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems (CHI EA '20).* (New York, NY: Association for Computing Machinery), 1–14. doi: 10.1145/3334480. 3381808

Yeoman, P., and Wilson, S. (2019). Designing for situated learning: understanding the relations between material properties, designed form and emergent learning activity. *Br. J. Educ. Technol.* 50, 2090–2108. doi: 10.1111/bjet. 12856