CO-DESIGNING AN INNOVATIVE ASSESSMENT TOOL FOR HIGHER EDUCATION: METHODS, CHALLENGES, AND INSIGHTS FROM PARTICIPATORY DESIGN

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ABSTRACT
Assessment in higher education faces numerous challenges due to reduced public funding, increased marketisation, the rise of new technologies, and students' demand for fair assessment. To address these issues, we used participatory design to develop an assessment framework and a tool to assist educators in creating innovative assessment methods. This paper aims to describe how we used participatory design as a method to develop a tool for educators in higher education. Although the development of the tool is still in progress, it has undergone multiple iterations and successful prototype trials. Over one hundred international educators have participated in the participatory design process. Key steps included idea generation, the development of assessment dimensions, user testing, feedback integration, and prototyping, all with a focus on human-centred design. Data were collected through questionnaires, interviews, observations, and testing. Educators from diverse disciplines, countries, and backgrounds found the tool useful and applicable, contributing insights from fields such as industrial design, architecture, engineering, technology, entrepreneurship, and business. Key challenges included balancing game elements with pedagogical value, integrating diverse feedback, adapting the tool for various educational contexts, ensuring commercial viability, and managing resource constraints. Despite these challenges, the tool shows promise for enhancing assessment practices across educational levels and disciplines. This article contributes to the understanding of how participatory design can be used to design and develop tools and products for educators in higher education and provides an overview of potential challenges to be aware of when initiating such processes.

Keywords: Educational tool, participatory design method, tool for assessment, product development

1 INTRODUCTION
Assessment in design and engineering is challenging. Some of these challenges come from reduced public funding and increased marketisation [1], the rise in new technologies that impact the student's way of responding to assignments [2], and students' demand for fair assessment [3]. To address these challenges, we aimed to assist educators in developing new and innovative assessment methods. We developed an assessment framework and a physical tool, drawing on the work of Topping [4], Pittaway & Edwards [5], Wenninger [6], and Babatunde et al. [7]. The process resulted in a conceptual framework for assessment and a physical tool for developing and improving assessment methods.
The tool is a deck of cards and has many of the same features as a card game. We explored various game mechanics, and the tool was launched as a first prototype in 2024 as the *SUPER Assessor*[1]. The primary user group of the tool is educators in higher education across disciplines, such as lecturers and professors, who use the tool to develop their own assessment methods. Students and administrators are the secondary user group. Due to both pedagogical and strategic considerations, it is important to include students and organisational leaders in the process to ensure a shared understanding of the strengths and limitations of different assessment methods.
The research question for this paper is: *What challenges can arise when developing a tool to improve assessment methods in higher education using the participatory design method?*
The paper begins by presenting literature on product development for educators in higher education, including educational tools and design approaches for creating such products. We then describe

[1] SUPER Assessor webpage: https://www.supereducator.no/product-page/super-assessor

participatory design [8] and how it has been applied in this study. Subsequently, we present the challenges encountered during the design process, reflect on these issues, and relate them to relevant literature

2 LITERATURES

2.1 Developing a product for educators in higher education

Higher education is a sector that has notorious difficulties with generating and exploiting innovations to improve practices, but the educational tool industry has emerged in the last decade [9]. Several have written about the development of games for students in higher and lower education [10, 11, 12, 13]. Ibrahim & Jaafar [14] show several frameworks that are developed for educational games. They all include different elements of game design, pedagogy, and learning content with an emphasis "on usability, multimodality, fun, motivation, problem-solving, and syllabus matching" [14]. Creating an educational game offers complexity in terms of balancing fun and engagement with learning and usefulness [14].

2.2 User and human-centred design

Design practice is often resource-constrained, with little time, financial investment, and professional expertise, and involving the users is often seen as an expensive luxury that is not always necessary [15]. Human-centred design (HCD) attempts to give users a voice or a role in their projects with the intention of developing products that match users' needs and preferences [16]. HCD is an approach to design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors of ergonomics and usability knowledge and techniques in the development process [17]. The aim of HCD is to get solutions that are useful, usable, desirable, and meaningful to the people using them. We can compare this method to the user-centred design, which has a narrower perspective on the users. The difference between human-centred design and user-centred design is that the former approach includes perspectives from people beyond their role as users and includes the different stakeholders' needs and a broader context [17]. User-centred design and specifically inclusive design is described as "*an approach that aims to create interfaces, artefacts, products, and services that are applicable, appropriate, and accessible to as many users as possible within the constraints of the design specification"* [18].

From another perspective, we can also use the approach of inclusive design, where the solution would focus on a product that solves the problem for users in different scenarios – this could be described as Keates [19] states, "*the design of mainstream products and/ or services that are accessible to, and usable by, as many people with the widest range of abilities within the widest range of situations without the need for special adaptation or specialised design".*

2.3 Participatory Design method in product development

Wilkinson & De Angeli [18] have looked at how the participatory design approach can be used for product research and development, and in their conclusion, they say the statement 'Users don't always know what they want' holds no merit. Participatory design includes users throughout the design process, and its key to enhance the adoption of the finalised design solution and to experience the user's needs [18]. Participatory design has also been used to develop educational research and educational tools [20, 21, 22].

3 METHOD

The five-person development team behind the educational tool has diverse study backgrounds and working experiences, but everyone has a teaching or research position in higher education. The disciplinary backgrounds of the team include design, engineering, psychology and business. The team has collaborated in the development of the educational tool, both with the product development and prototyping, the research behind the tool, and the commercialisation process.

3.1 Participatory design as a method to develop an educational tool

The development of this tool began in the spring of 2023, following the method outlined by Spinuzzi [8]. The development team has led this process, however, over a hundred international educators have participated in the testing of various prototypes. Our development process was an iterative process moving between the three stages of exploration, discovery, and prototyping. The steps we conducted for the development were the following:

1. **Analyse current assessment practices and status quo.** During this phase, we interviewed educators, analysed current assessment practices at our own institutions and the current challenges of these. Based on the research, we defined the problem: "*Educators still use traditional assessment methods, though pedagogical knowledge and practices has developed.*" Based on this problem, we decided on the aim of *creating a tool that could help educators reflect on and develop their assessment methods.*
2. **Exploratory idea generation.** Here we ideated various solutions to the problem. This included a four-piece puzzle where each piece represented a part of an assessment, and various forms of board games. We started experimenting and developing the concept further to find how assessment methods could be represented in game form.
3. **Development of assessment dimensions.** Based on discussions within the team and our previous work, we created several dimensions and, after a while, understood that the format could be suitable as a card game.
4. **Designing and developing prototypes.** Based on the ideas and dimensions from the previous step, we created a paper prototype—a deck of cards with different categories. By populating each category with various methods, the categories became clearer to us.
5. **Evaluate prototypes.** The prototypes were brought to conferences, and oral feedback from the participants was noted down throughout the session.
6. **Revise framework.** After receiving feedback during testing of the prototype, the feedback was discussed, as well as observations from the conference sessions, to add new elements to the game.
7. **Redesign prototypes.** The development has gone from low fidelity prototypes with only printed pictures to high fidelity prototypes with printed cards. There were several trials included in this process.
8. **Revise framework.** After receiving feedback during testing of the prototype, the feedback was discussed, as well as observations from the conference sessions, to revise the game. In this step we removed some elements.
9. **Evaluate and redesign prototypes.** Based on the revisions from the former round, the prototype was redesigned with new content. The new prototype was brought to new workshops and another conference, to test the new content and mechanics using the primary user group – educators in higher education. In this round, both post-it notes and a survey were used to gather feedback. Steps 4, 5, and 6 were repeated several times. We used all opportunities we had to test the tool in different formats and events. Sometimes, we were invited in; other times, we created the testing setting ourselves.
10. **Revise framework.** All feedback and observations made during the workshops were reviewed. While much of the current content was confirmed as relevant and useful, some reoccurring comments were also made for revisions. The tool has been revised nine times so far, and we have one product named 'SUPER Assessor,' which is in English for educators in higher education and is illustrated in Figure 1.

3.2 Data collection and sample

Data was collected through the testing of the tool, primarily in group settings where the development team conducted workshops or sessions for educators to further develop their courses (see pictures from the workshop and the tool below). The most central data collection points were from international conferences, where we were able to gather insights and feedback from experienced and interested scholars, but also internal workshops were important to gather focused feedback on specific aspects of the tool and ideas on how to improve the tool. Participants experienced varying levels of relevance and engagement during these workshops and sessions; some were able to work hands-on with their own courses and implement changes shortly after. Data collection methods included surveys, interviews, and observations, often guided by an agenda that ranged from overall experiences to more detailed elements. All feedback and data were then analysed in the development group regarding relevance and feasibility. We considered something relevant if it was feedback that contributed to the tool's overarching purpose. We considered something as feasible if the feedback from the users was possible to implement.

The tool was tested by educators from a diverse selection of disciplines, countries, and experiences, who mostly found it useful and applicable to their contexts. This broad network facilitated the inclusion of diverse perspectives and insights from fields such as industrial design, architecture, engineering, technology, teaching practices, biology, entrepreneurship, and business, among others. The participants,

who held positions as professors, lecturers, course coordinators, and PhD students, all contributed their views and feedback.

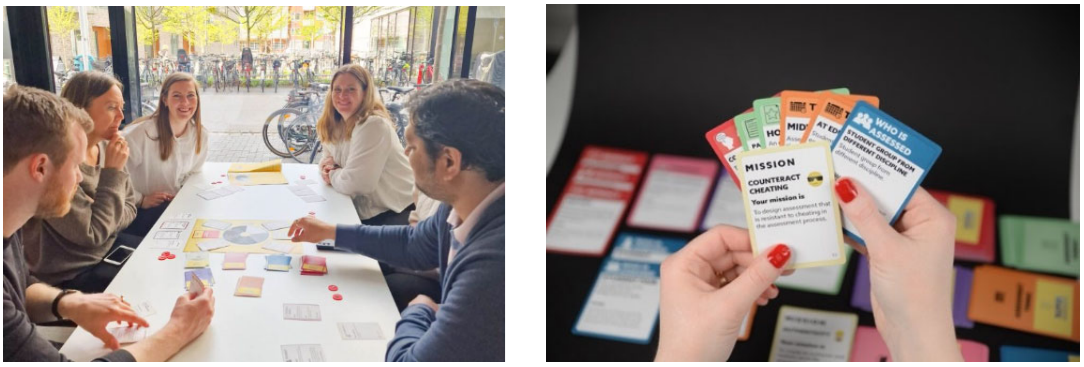

Figure 1. Pictures from the human-centred design process (left) and the final tool (right)

4 FINDINGS

In developing the tool, we encountered several core challenges related to participatory design and designing for educators in higher education. The process was key in order to improve and develop the product. The following themes emerged from our iterative process and extensive user engagement:

4.1 Grounding Design in Real-World Needs

The initial phase of the participatory design process was crucial for grounding the tool in real-world needs. Through workshops and discussions, we identified relevant frameworks and uncovered key challenges faced by educators. These insights directly informed the direction and development of the first prototypes, ensuring the tool addressed authentic pedagogical concerns. Especially digital development (e.g. AI tools) poses a challenge to the current assessment practices, so many educators saw this tool as a good support.

4.2 Balancing Game Elements with Pedagogical Utility

Integrating game elements boosted engagement but risked overshadowing pedagogical value. We experimented with two versions: one emphasising competition and laughter to facilitate tool familiarisation, and another focused on structured idea generation for experienced educators. Both approaches supported awareness of assessment structures, but striking the right balance was critical – too much gameplay reduced reflection, too little limited exploration of the tool's full potential. The users did not agree on which way they preferred to use the game – there were a lot of different options about the user situation and needs.

4.3 Feedback Integration

Collecting feedback from a broad group of educators revealed tensions between conflicting suggestions. As qualitative researchers, we were aware of our interpretive influence during the process. Deciding when to shift from iteration to prototype production required careful judgment, especially as each session introduced new ideas worth considering. It has been especially great to run workshops at conferences when participants are eager and have an open mindset – this is some of the best arenas to test and get feedback.

4.4 Adaptation Across Contexts

To ensure relevance across disciplines (e.g. engineering, design), the tool was tested and adapted with input from diverse educators. Though designed for higher education, interest from secondary education prompted further refinements, highlighting the tool's potential for broader applicability. This is also a clear result from the choice of including a lot of different users from different disciplines; they added features and elements that they saw as useful. One of the dimensions in the tool is especially inspired from more creative disciplines, such as design (e.g. artifact cards that have a wide variety). The design discipline is a great inspiration for assessment in other disciplines.

4.5 Commercial Viability

Despite positive reception, the tool's path to commercialisation was not straightforward. Key challenges included funding, institutional bureaucracy, and a misalignment between users (educators) and potential paying customers (institutions). We are currently developing a distribution strategy and seeking external funding to support this transition. The user-based view of the participatory design method during the product development does not include a market perspective or commercial aspects. From an early stage, the project lacked a business model and an understanding of how to reach potential customers who could have an interest in using the tool.

4.6 Resource Constraints

Development required significant time and effort, often beyond funded project periods. Team members' expertise in design and participatory methods improved efficiency, but ongoing progress depends largely on intrinsic motivation, as all members maintain full-time academic roles. This is a continuous challenge now that the team is working on the commercialisation of the game.

4.7 Post-Launch Feedback

The tool has been adopted in various educational settings, with several sales through our online store. While some users continue with earlier prototypes, the latest version is appreciated for its adaptability and sustained relevance. Its "missions" continue to prompt timely reflection on diverse academic perspectives, especially in an era of tightening higher education budgets.

5 DISCUSSION AND CONCLUSION

This paper has demonstrated how participatory design methods can be applied to the development of a physical educational tool – the SUPER Assessor – aimed at improving assessment practices in higher education. The findings reinforce the importance of involving users not only as testers but as co-creators throughout the development process. The literature highlights the complexity of creating educational games that balance engagement with pedagogical utility [14]. This complexity was evident in our development process, where we struggled to maintain the educational value of the tool while incorporating game elements to enhance engagement. The feedback from educators was invaluable, yet often conflicting, necessitating careful evaluation to integrate the most beneficial suggestions. Even if a user might know what they want, it is hard to include all their needs in a tool. This aligns with the principles of human-centred design (HCD), which emphasises the importance of user involvement in the design process to create solutions that are useful, usable, and meaningful [16, 17]. Although a lot of educators saw the relevance, this led to a non-discipline-specific development of the tool. In this user-based method, the preferences of the user group have a heavy involvement in the development. We strongly suggest that those who are developing a tool for educators use educational conferences where participants are eager and open-minded. Moreover, adapting the tool for different educational contexts required extensive testing and feedback integration, reflecting the inclusive design approach that aims to create accessible and applicable products for a wide range of users [19]. Despite positive feedback, commercial viability remains a challenge, highlighting the need for strategic planning and resource allocation. The participatory design method proved essential in ensuring the tool met the diverse needs of educators, reinforcing the notion that user involvement is crucial for successful product development [18]. The participatory method lacks a marked specific approach. We suggest combining this method with early market studies to make the commercialisation process less challenging.

In conclusion, this paper describes how educators in higher education can develop a tool for educators with the method of Spinuzzi [8]. The method is briefly described, and by employing this participatory design method, we ensured that the tool was shaped by the needs and with feedback from its primary users. This approach not only enhanced the tool's relevance and usability but also underscored the importance of user involvement in the design process. However, commercial viability remains a significant hurdle, necessitating further strategic planning and resource allocation. The insights gained from this project reinforce the value of human-centred and inclusive design approaches in creating innovative and effective educational tools.

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