# A BLENDED APPROACH OF ONLINE TOOLS TO ENHANCE COLLABORATION ABILITY IN DESIGN EDUCATION

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## ABSTRACT

Collaboration is essential to design and is a learned skill that needs to be integrated deeply into educational processes. Teamwork enables students to look beyond their own space, time, and culture, preparing them for collaborative work in their future design practice. This study tested a blended approach of online tools in the design education process, demonstrating improved student engagement in collaboration. The online tools discussed in this study include Slack, Figma, Miro, and a card-based online workshop tool designed by the team.

The study followed a design course at a college from 2019 to 2022, discussing how online tools affect the design education process in a graduate-level studio course. The main objective was to evaluate how online tools impacted students' learning and collaboration performance. Firstly, we focused on the co-creation and the competencies developed in the collaboration process. Then, we examined the quality of the design projects and correlated it to the effectiveness of communication within the teams. Data were collected through surveys and self-reflective writings at the end of each semester, and comparative studies were conducted on intercultural collaborative project outcomes versus traditional in-house team projects.

The results revealed that the blended approach generated promising statistics regarding learning and collaboration inclination and teamwork engagement. The advantages and values created are summarised in the conclusion.

*Keywords: Design education, collaboration ability, online education tools*

## 1 INTRODUCTION

Design education serves as a cornerstone for preparing future designers to navigate the complexities of the modern world. Central to this preparation is the cultivation of collaboration, a fundamental skill that transcends individual capabilities and fosters collective creativity and innovation. Collaboration in design education is not merely about working together; it's about embracing diverse perspectives, leveraging collective expertise, and co-creating solutions that address real-world challenges.

In recent years, advancements in technology have reshaped the landscape of design education, offering new opportunities to enhance collaboration through the integration of online tools. The rationale for integrating these tools into design education is grounded in their capacity to overcome traditional constraints, such as geographical distance and time limitations, while fostering a culture of connectivity and collaboration among students. By leveraging online tools, educators can create immersive learning experiences that transcend the boundaries of the physical classroom, empowering students to collaborate seamlessly and engage in meaningful dialogue regardless of their location.

The present study aims to explore the transformative potential of online tools in augmenting collaboration ability within the context of design education. By examining the impact of a blended approach that incorporates online tools such as Slack, Figma, Miro, and a card-based workshop tool, the study seeks to elucidate how technology-enhanced collaboration influences students' learning outcomes and collaboration performance. Through a longitudinal analysis spanning from 2019 to 2022, the study evaluates the effectiveness of online tools in promoting co-creation, developing collaborative competencies, and enhancing project quality in a graduate-level design course.

# 2 LITERATURE REVIEW

## 2.1 The Importance of Collaboration in Design Education

In the field of design practices, cultivating collaboration is foundational, fostering an environment where creativity and innovation thrive to address the increasingly complex problems designers face (Nielsen et al., 2019). Design education aims to "serve environmental, technological, and societal changes and challenges" (Wu et al., 2021). Currently, design education has moved towards a collaborative practice, where designers work in teams and collaborate with other disciplines to solve unstructured problems. In this process, designers need relevant collaboration skills, including cognition, teamwork, information sharing, negotiating common ground, and reaching consensus (Kiernan et al., 2017).

Furthermore, collaboration in design education reflects the interdisciplinary nature of professional design practice and mirrors the collaborative processes prevalent in the industry. However, it is less so in education where the curricular structure and requirement for assessment make implementation difficult (Kiernan & Ledwith, 2014). Therefore, there is a call for more related research on design collaboration within the design education community.

It is now common in contemporary graduate design education for co-design, speculative, and futures-focused approaches to be embedded into curricula to support critical exploration (McAra & Ross, 2020). Traditional individual design skills cannot meet these emerging design methods. Brainstorming, facilitation, choreography, empathy, and translation are collaborative skills that support this new practical field of design education (Örnekoğlu-Selçuk et al., 2023), which are also key transferable skills for design students entering the industry in the future.

## 2.2 Emerging Online Tools' Potential in Design Education

While collaboration and communication tools have developed with new computer technologies, there appear to be fewer digital/online creative design methods compared to physical creative methods (Brisco et al., 2021). Online tools combined with specific or integrated design methods can better allow the occurrence of design ideation to support future-oriented complex and varied design activities. For example, a tool developed by Wenzel et al. (2016) called 'Tele-Board' supports design thinking through remote collaboration.

Currently, one of the most common online tools is the digital whiteboard, where many users can share ideas, brainstorm, and conduct specific design collaboration activities on a virtual whiteboard (Brisco et al., 2021). This form aligns with the thinking patterns of designers starting from scratch in real scenarios. Many developments of shared whiteboards have appeared and are commonly used by design teams, including Miro, Figma, and Butter. These collaborative whiteboards can provide necessary design methods and process templates for design activities to support users in better collaboration. At the same time, other online tools for design collaboration have also attracted attention, such as the card-based brainstorming tool (Liu et al., 2023) and the prototyping tool ‘Designy’ (Ramos & Wallace, 2019). However, there is little research on how different online tools work together to affect design students' collaboration abilities in design education environments.

# 3 METHODOLOGIES

The study was conducted within the framework of a graduate-level design course spanning three academic years, from 2019 to 2022. The course aimed to provide students with comprehensive training in various aspects of design, including conceptualisation, prototyping, and project management, while emphasising the importance of collaboration in the design process. Throughout the course, students engaged in a series of collaborative projects designed to simulate real-world design scenarios and encourage teamwork and interdisciplinary collaboration.

Description of the Design Course:

**Contact Hours：** 55 hours

**Major:** Environmental Design, Interaction Design

**Assessment：** course work and assignments

**Prerequisite：** Design Basics

**Students：** maximum 16(divide into 3-4groups)

**The course is structured in three modules:**

1. Lectures and Seminars 1 (8 hours)

Based on the selected topic, the course will have selected lectures, mainly to introduce the relevant theory, research and design skills, and expertise related to the subject and so on.

2. Workshop (41 hours) (group work)
   Project in the real world with real community users and needs such as small-scale community renew. With complex context and stakeholders to communicate and research, students will need to use more broad knowledge and skills to solve problem. Throughout the workshop, students will apply broad-ranging knowledge and skills to tackle complex problems. From conducting field research and analysing users to crafting strategies and conceptual designs, to developing prototypes and gathering feedback, this workshop offers a comprehensive exploration of the project process.
3. Exhibition and Presentation (6 hours)
   Concluding the course, an exhibition and seminar will be orchestrated to facilitate the exchange and sharing of experiences among participants.

## 3.1 Overview of the Online Tools Utilised

1. Slack: A messaging and communication platform that enabled real-time communication, file sharing, and collaboration among team members. Slack serves as a dynamic messaging and communication platform, fostering real-time interaction, seamless file sharing, and effective collaboration among team members. Through its versatile features, students engage in swift exchanges, share resources effortlessly, and collectively refine their creative endeavours within the studio environment.
2. Figma: A cloud-based design tool that allowed students to collaborate on design projects in real-time, providing features for prototyping, wireframing, and design iteration.
   Within the Design Studio Course, Figma emerges as a pivotal asset, offering a cloud-based design platform that empowers students to collaborate seamlessly on design projects in real-time. Equipped with robust features for prototyping, wireframing, and iterative design processes, Figma provides a versatile canvas for students to bring their ideas to life collectively, fostering innovation and iteration within the collaborative studio environment.
3. Miro: Similar to Figma, Miro is an online whiteboarding platform that facilitated visual collaboration, brainstorming, and ideation sessions among distributed teams. By providing an intuitive virtual workspace, Miro enables students to ideate, organise thoughts, and co-create visually, fostering a dynamic and inclusive creative process that transcends physical boundaries.
4. Zoom: Video conferencing tool for remote meetings, critiques, and workshops.
5. A card-based workshop tool designed by our team is used in the brainstorming phase of the design workshop. Drawing on metaphor design methods in interaction design, this tool is designed with multiple interactions and four adapted desktop modes. Students can improve communication, creativity, and engagement among team members through this card-based workshop tool (Liu et al., 2023). The tool helps students output content in the form of text, pictures, and videos from specific thinking perspectives. This interaction promotes students' online participatory discussions and information exchanges, and the diverse desktop modes give students a higher sense of presence when participating in online workshops. This research focuses on the tool's impact on communication, creativity, and engagement in students' collaborative abilities.


Room mode Spotlight mode

*Figure 1. Card-based Online Workshop Tool*

## 3.2 Data Collection Methods

1. Surveys: Designing surveys to gather quantitative data from students regarding their perceptions of collaboration effectiveness, and their learning outcomes.

2. Self-reflection writings: Asking students to write reflective essays at the end of each semester to gather qualitative insights into their learning experiences, collaboration processes, and perceived impact on their design projects.
3. Observational studies: Observing students' interactions and behaviours during collaborative activities. This can provide valuable qualitative data on communication effectiveness, and engagement levels.
4. Interviews: Conducting semi-structured interviews with students and instructors to gather in-depth insights into their experiences.

   These data collection methods can provide a comprehensive understanding of how the online tools impact students' learning and collaboration performance in the design education process.

### 3.3 Comparative Study Design between Online Learning and Traditional In-House Team

The research team conducted comparative study to analyse and compare the outcomes of two tests of design education process: those using online collaborative platforms and those executed by traditional in-house teams. The study aims to assess the impact of online tools on collaboration effectiveness, project quality, and learning outcomes in the context of design education.

1. Participant Selection:

   The grouping method was primarily based on students' voluntary selection. In 2019, all students opted for offline groupings and exclusively utilised offline tools. In contrast, in 2021, all students chose a combination of online and offline tools. However, due to the pandemic in 2020, some students attended classes online while others attended offline, naturally forming two control groups.

*Table 1. Participants and the comparison of online/offline tools*

| year | Course scale | Students' info | Online tools | Offline tools* | Notes |
|---|---|---|---|---|---|
| 2019 autumn semester | 9 students | All offline | —— | Whiteboards | All students attended classes offline and utilised offline supplementary tools. |
| | | | | Pin-up kits | |
| | | | | Storyboard templates | |
| | | | | Design Critique Cards | |
| | | | | Design Workshop Kits | |
| 2020 autumn semester | 10 students | Group A 4 offline | —— | Whiteboards | Due to the pandemic, for the 2020 academic year, students of this course attended classes partially online and partially offline. |
| | | | | Pin-up kits | |
| | | | | Storyboard templates | |
| | | | | Design Critique Cards | |
| | | | | Design Workshop Kits | |
| | | Group B 6 online | Slack | Design Critique Cards | |
| | | | Figma/Miro | Design Workshop Kits | |
| | | | Zoom | | |
| 2021 autumn semester | 16 students | All offline | Slack | Whiteboards | Students voluntarily grouped themselves and choose between using online tools or offline tools. However, all students opted to utilise online tools to supplement their course learning. |
| | | | Figma/Miro | Pin-up kits | |
| | | | Card-based Workshop Tool | Storyboard templates | |
| | | | | Design Critique Cards | |
| | | | zoom | Design Workshop Kits | |

* The offline tools listed in this table exclusively comprise those geared towards teamwork and collaboration.

2. Data Analysis:
   - Quantitative analysis: Quantitative analysis will involve statistical analysis of scores provided by the same group of teachers to compare differences between the two groups.
   - Qualitative analysis: Thematic analysis will be conducted on self-reflection writings and interview transcripts to identify common themes and patterns related to collaboration effectiveness and project quality.
3. Outcome Measures:
   - Collaboration effectiveness: Assessing factors such as communication clarity, teamwork cohesion, and task coordination.

- Project quality: Evaluating the creativity, functionality, and innovation demonstrated in the final design outcomes. (Figure 2)
- Learning outcomes: Examining the development of collaborative skills, cross-cultural competencies, and design proficiency. (Figure 3）

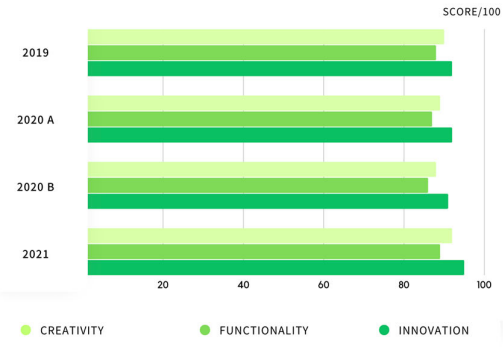


*Figure 2. Project quality analysis*

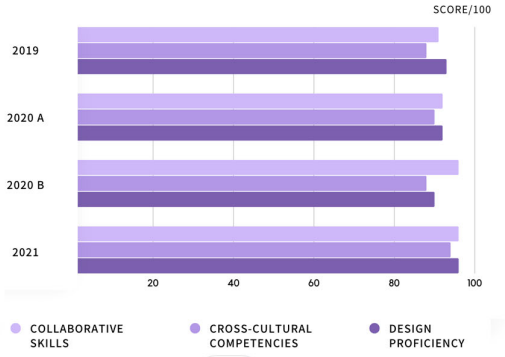


*Figure 3. Learning outcomes analysis*

## 4 FINDINGS

1. Collaboration effectiveness

After analysing the results of the questionnaires and interviews, the findings reveal that online learning platforms enhance collaboration by providing tools for "real-time communication," "document sharing," and "collaborative editing." On the other hand, traditional in-house teams may excel in collaboration due to face-to-face interactions, non-verbal cues, and immediate problem-solving. The following points summarise arguments cited from the interviews:

(1) Knowledge Sharing: "*Slack facilitates asynchronous communication, allowing us to share insights, resources, and experiences across diverse time zones and locations." "Slack enables us to access resources at our own pace and convenience,*" while traditional teams may face constraints related to fixed schedules and physical presence.

(2) Conflict Resolution: Online platforms may "*provide structured channels for resolving conflicts, such as anonymous voting mechanisms in the Card-based Workshop Tool"*. In contrast, traditional teams may rely on face-to-face meetings and interpersonal skills to address conflicts in real-time.

(3) Adaptability to Change: When facing the changes such as project requirements, deadlines, or external factors, *"online platforms may enable rapid adaptation through agile methodologies, such as Zoom virtual meetings, and remote collaboration tools Figma or Miro"*. In contrast, traditional teams may "*face challenges in adjusting to change due to established workflows, work breakdown structures, and communication norms*".

2. Project quality

Through the statistical analysis of scores provided by the same group of teachers to compare differences between the two groups (Figure 1, 2), the results indicate that the group combining online learning and in-house working in 2021 exhibited the highest level of project quality. This finding suggests that integrating elements of both online learning platforms and traditional in-house collaboration methodologies leads to optimal project outcomes. By leveraging the advantages of online tools for asynchronous communication, remote collaboration, and access to diverse perspectives, while also harnessing the strengths of face-to-face interactions, immediate feedback, and established workflows inherent in traditional in-house teams, this hybrid approach maximises project quality. The synergy between online and in-house working environments creates a dynamic and adaptable project environment that fosters innovation, thorough problem-solving, and effective coordination, ultimately resulting in superior project deliverables.

3. Learning outcomes

Findings could demonstrate differences in learning outcomes across the different collaboration modes.

(1) Collaborative Skills: The findings indicate that the online group and the combined group demonstrated notable advancements in collaborative skills. Through the utilisation of online platforms and in-person interactions, team members honed their ability to communicate effectively, collaborate with diverse team members, and navigate complex project dynamics.

(2) Cross-cultural Competencies: The integration of online learning platforms facilitated interactions among team members from diverse cultural backgrounds, leading to enhanced cross-cultural competencies. Through virtual collaboration and asynchronous communication, students gained exposure to diverse viewpoints, enriched the learning experience, broadened their cultural awareness, and equipped them with the skills necessary to collaborate effectively in multicultural environments.

(3) Design Proficiency: Analysis of learning outcomes also revealed improvements in design proficiency among students engaged in the combined working model. By leveraging online design tools, accessing educational resources, and participating in hands-on design projects, students developed technical skills, creativity, and critical thinking abilities essential for success in design-related fields. Additionally, the integration of traditional in-house collaboration methods facilitated mentorship, peer feedback, and practical skill development, further enhancing students' design proficiency and readiness for professional practice.

## 5 DISCUSSIONS

This study remains ongoing, as the limited number of students in each semester and the inherent variability in student characteristics pose challenges to drawing definitive conclusions from the comparative research. The findings of this study should therefore be considered as indicative rather than conclusive. The research team acknowledges the need for continued investigation into this topic, recognising the importance of further tracking and analysis to deepen our understanding of the dynamics at play. Moving forward, the research team is committed to ongoing monitoring and evaluation, aiming to elucidate the nuanced relationships between collaboration modes and learning outcomes over time.

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