EXPLORING THE IMPACT AND CHALLENGES OF AN EMBODIED AND IMPROVISATION-BASED COURSE: INSIGHTS FROM ENGINEERING STUDENTS

M. Studer[1]
Ecole Polytechnique Fédérale de Lausanne
Lausanne, Switzerland
0009-0001-0423-0618

E. S. Cross
Eidgenössische Technische Hochschule Zürich
Zürich, Switzerland
0000-0002-1671-5698

S. Henein
Ecole Polytechnique Fédérale de Lausanne
Lausanne, Switzerland
0000-0002-8441-7772

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[1] *Corresponding Author: M. Studer, Studer.melanie@gmail.com*

ABSTRACT

This study employs thematic analysis to delve into the experiences of 12 alumni engineering students who participated in the elective course "Collective Creation: Improvised Arts and Engineering" at the Swiss Federal Institute of Technology of Lausanne (EPFL) since 2017. Focusing on the lasting impressions left on alumni, the research investigates retained knowledge and skills, their impact on educational journeys, and relevance to professional development. Furthermore, it explores barriers hindering the transferability of acquired skills and knowledge to diverse contexts. The findings underscore the enduring emotional resonance of the course experience for alumni, emphasizing feelings over measurable cognitive knowledge retention. While alumni express gratitude for the course, they encounter challenges in articulating its direct contributions to their professional lives, suggesting a gap between experiential learning outcomes and traditional measures of educational and career success.

1 INTRODUCTION

The course "Collective Creation: Improvised Arts and Engineering," abbreviated as *Improgineering*, has been taught annually since its inception in 2017, apart from the academic year 2021-2022, at the Ecole Polytechnique Fédérale de Lausanne (EPFL). Situated within the university's Social Sciences and Humanities (SHS) program, this 6 ECTS elective course leads students into improvisation techniques developed in the performing arts (theatre, music, dance, performance) and questions their possible transposition to engineering design practices. The course spans a full academic year and comprises three hours of weekly classes conducted in a nearby theater. Each year, a cohort of first-year Master students from various disciplines follow this course, taught by an Engineering Professor who is also a dancer and complemented by teachers from diverse backgrounds such as theater, music, dance, neuroscience, and sociology. The first semester encompasses theoretical courses on improvisation as well as several practical workshops. The second semester encompasses further practical workshops, including workshops designed by student groups preparing themselves for the final public performance of the course. At the end of the academic year, students stage a public performance in front of an evaluating jury in a theater where they perform two 12-minute improvisations, one in a small group (3 to 5 people) and another with the whole class. [2]

Each year, the students assign high evaluations to the course. But what remains unknown is what sticks with the alumni after the course: What have they learned and how has it contributed to their education and professional life? Is it possible to articulate anything that may have impeded a transfer of the knowledge and skills learned to other settings?

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[2] More information about the course can be found in the book *Barefoot Academic Teaching* (Tau et al. 2024), the website https://www.epfl.ch/labs/instantlab/improgineering/ and the video https://vimeo.com/281099868.

2 THEORETICAL GROUNDING

This study is grounded in theories on embodied learning. According to Nguyen and Larson (2015, p.2) embodied learning consist in "joining body and mind in a physical and mental act of knowledge construction". This integrative and holistic approach to education nurtures the learner's physical, emotional, mental, and spiritual development (Freiler, 2008).

Researchers have outlined numerous benefits associated with bringing back the body into the classroom. Firstly, embodied learning has been shown to enhance retention and foster deeper engagement and enjoyment among students (Macedonia 2019; Lipson Lawrence 2012; Strean 2011). Shared embodied experiences also cultivate bonds among students and between students and teachers, fostering belonging and inclusion (Doshi and Osborne 2023; Garrett and MacGill 2021; Solomon et al. 2022). Additionally, participation in embodied activities enhances self-awareness and sensitivity to others, nurturing improved collaborative relationships (Lipson Lawrence 2012). Finally, embodied learning has been found to benefit wellbeing (Rodríguez-Jiménez et al. 2022) and creativity (Dawson 2018).

Despite a growing number of initiatives and studies exploring embodied learning, most efforts are concentrated at the elementary levels of education, as well as within informal learning settings. In contrast, there remains a significant gap in research concerning the integration of embodied learning methodologies into higher education (Clughen 2023). As such, only two empirical studies on the use of embodied learning in engineering education could be found in literature.

In Spain at the Department of Science, Technology and Design, at the Universidad Europea de Madrid, Rodríguez-Jiménez et al. (2022) have used embodied learning with engineering students as a strategy for increasing wellbeing. At the Royal Institute of Technology in Sweden, Brandimarte, Funk, and Richter (2024) have experimented with mixing mechanical engineering and circus students to enhance learning. To the best of our knowledge no course like "Improgineering", which proposes to use embodied and improvisation practice to teach engineering students collective creativity, exists in other engineering education institutions in the world.

3 METHODOLOGY

This research employs a qualitative methodology, utilizing semi-structured interviews to gather data from alumni of the Improgineering course who volunteered to participate in the study. Participants were recruited via an invitation email sent to 111 out of 119 alumni who had provided an alumni email address. Additionally, a WhatsApp message was sent to a WhatsApp group composed of 31 alumni, who had provided their phone numbers to the teacher after completing the course. Eventually, a total of 12 individuals volunteered for an interview, representing approximately 10% of the students who have followed this course since its launch.

The interviews were conducted remotely over Zoom, with each session lasting approximately 30 minutes. Following the interviews, transcripts were generated and anonymized to protect participants' identities. The data analysis followed a thematic analysis approach according to Braun and Clarke (2021), whereby transcripts were systematically examined to identify recurring themes and patterns within the responses provided by participants. This process involved coding the data based on emergent themes and sub-themes, allowing for a comprehensive understanding of

the experiences and perceptions of alumni regarding their participation in the Improgineering course.

The demographics of the participants of the study are summarized in Table 1.

Table 1. Demographics of participants of the study

		Frequency	Percentage
Gender	Female	10	83%
	Male	2	17%
Year of course	2017-2018	2	17%
	2018-2019	1	8%
	2021-2022	5	42%
	2022-2023	4	33%
Background	Robotics	1	8%
	Computer science	1	8%
	Computational science	1	8%
	Microengineering	2	17%
	Environmental Science and Engineering	3	25%
	Architecture	4	33%

4 RESULTS

4.1 Theme 1: Impact of the course

Teamwork

Participants emphasized that improvisation served as an effective vehicle for learning teamwork skills, fostering the ability to listen, collaborate, and build on each other's ideas. The absence of pressure on the outcome of the course project further contributed to teamwork dynamics. Interviewee D articulated this sentiment, stating, *"Working without a specific goal was really interesting to be able to work better as a group, because then there wasn't the pressure you usually have with a project where you have to turn in your work on time, with lots of objectives set by the teacher. I think that's what made it so easy to get along in your group."*

Learning effective teamwork was particularly valued, with some interviewees highlighting the lack of emphasis on teamwork skills in traditional engineering courses. Interviewee A expressed the opinion that such a course should be made available to all students, emphasizing its relevance not only in engineering but also in various professional contexts. They stated, *"if everyone followed that [this course], we'd be so much better off in the projects. So in my opinion, this course should be available to everyone. These are things [group work, listening to each other] we don't develop at all, yet it's super necessary for me, in any profession in general and of course in engineering too."*

Sense of belonging and trust

Interacting extensively, including through touch, and engaging in experiential activities together fostered deep bonds among students, creating a sense of belonging, trust, and ease within the group. Descriptions such as feeling like a cohesive unit or a tightly knit troupe were common among interviewees. Interviewee F described the atmosphere as unique, stating, *"it created an atmosphere that I've never found in any other course. It was really a team and that was special."* This

safety, felt within the group, allowed participants to engage in activities they might not have otherwise felt comfortable doing. Interviewee L noted, "*everyone felt very comfortable and allowed themselves to do things that perhaps even in other groups, be they friends or associations, they wouldn't have allowed themselves to do.*"

Wellbeing & positive affect

Despite not being explicitly designed as a wellbeing program, the course had significant positive effects on participants' wellbeing. Many interviewees reported feeling relaxed and in the present moment during the course, likening the experience to a sense of "*breathing*" or to a session of meditation or sports. Terms like "*soft bubble*", "*oasis*" or "*break*" were also used to characterize the course. This positive affect was linked to feeling amused, free, connected to others, engaged physically but also to the novelty of the experience, as expressed by Interviewee D, who stated, "*It felt good also to just do something completely different.*"

Sense of freedom

Participants described feeling "liberated" in multiple senses within the course environment: free to be themselves, express themselves, explore, experiment, create, imagine, play, let go, and follow their intuition. This sense of freedom was fostered by the safe space created and the absence of rigid expectations regarding specific outcomes. Participants contrasted this freedom with the often restrictive nature of engineering curricula, where solutions are predefined, and answers are either right or wrong. Interviewee E highlighted this contrast, stating, "*we could test just about anything and everything. As a result, we were much freer in our creation.*" This freedom was perceived as both rare and beneficial for creativity within the context of their studies.

4.2 Theme 2: the perks and downsides of doing something unusual

Participants frequently characterized the Improgineering course as "*atypical*", "*completely different*", "*astonishing*", "*hyper*-special", "*extra-ordinary*", "*unusual*". While this distinctiveness contributes to the course's memorability, it also introduces challenges.

Many participants cited the course as one of the most memorable experiences during their studies due to its pedagogical approach, which diverged significantly from other courses. Interviewee E reflected, "*At every class, I'd come out surprised by what had happened. So I think that's why it had a big impact on me.*" The interactive and embodied nature of the course, combined with its demand for engagement in unfamiliar activities, fostered a lasting bodily memory and prevented any possibility of escaping behind screens.

However, the unconventional nature of the course also led some participants to perceive it as less serious compared to traditional courses. Interviewee E contemplated the impact of pedagogical norms however, stating, "*I think it gives the impression that it's not so serious when it's an exception among all our other courses. But if all our courses were like that, it becomes a bit of a norm and we get used to learning that way.*"

Moreover, some participants found difficult to relate the course to their engineering work. Interviewee H articulated this struggle, noting, "*it's both super interesting to do it [the course], but also super difficult to relate it to reality, to our daily life.*"

4.3 Theme 3: A complex contribution to professional life and studies

Interviewees mentioned feeling enriched by the Improgineering course and grateful for it. For a few recent alumni, the course fostered professional reflections. For example, Interviewee F thought "*I should never have studied something like engineering, but something else that's more fun*" or Interviewee K reflected that the course reinforced "*the idea I already had that a job where you're creative is something I'd really like to do*". While other interviewees felt the course contributed especially to their personal lives, art and creativity practice.

In general, the interviewees acknowledged the acquisition of a wide array of transversal skills, spanning creativity, reflexivity, daring, risk-taking, self-confidence, public speaking, intuition, adaptability, and imagination. Despite this recognition, articulating specific examples or quantifying the course's impact on their professional lives proved challenging for participants. Interviewee H candidly expressed this difficulty, stating, "*I can't really measure the influence it's had on my life, but it's certainly had an impact, but in my everyday life, I couldn't say that it's helped me.*" This sentiment resonated with other participants, who described the effects as "*subtle*," "*indirect*," or "*unconscious*."

Participants acknowledged also the complexity of evaluating the course's effects within the broader context of their professional and personal experiences. Interviewee B captured this sentiment, likening the course's impact to "*one brick in an accumulation of bricks.*" They elaborated, "*I don't know if it's enriched things a little, but in any case, it hasn't metamorphosed my way of thinking, and I don't actively think about it again.*" This perspective underscores the gradual and integrated nature of learning, suggesting that the effects of the course may manifest over time and in conjunction with other experiences.

4.4 Theme 4: Barriers to transfer

Interviewees identified several barriers hindering the seamless transfer of skills and knowledge acquired in the Improgineering course to their professional lives.

A prominent barrier highlighted by Interviewee I is the stark misalignment between the sedentary nature of their engineering work and the movement aspect emphasized in the course. Interviewee I admitted, "*I must confess that anything to do with movement, unfortunately, I don't really have many opportunities to apply it because in computer science, well, you're sitting behind a computer half the time.*"

Moreover, participants lamented the structured and often non-cocreative nature of their engineering work, which limits opportunities for creative expression. Interviewee H articulated this sentiment, reflecting, "*It's never very creative or it's called brainstorming when you're working. I admit I allow myself to be creative more alone than collectively.*"

Additionally, participants identified a lack of familiarity among their peers and colleagues with the co-creative methodologies taught in the course as a significant barrier to implementation. Interviewee A observed, "*The majority of people in this school (...) haven't had that kind of training. (...) And as a result, it's extremely difficult to implement. Because if I listen but they don't listen to me, it doesn't work either.*"

5 LIMITATIONS OF THE STUDY

The study is subject to several limitations, each of which bears implications for the interpretation and generalizability of the findings.

The first set of limitations pertains to the characteristics of the research sample. Notably, the self-selection bias among alumni who volunteered for interviews may lean towards individuals with a more positive perception of the course, potentially skewing the representation of its effects. Secondly, the predominance of recent graduates among interviewees limits insights into the long-term professional impact of the course. Lastly, female alumnae are overrepresented in the research sample as the course has about 50% female students, while this study sample is 83% female. Conducting additional interviews with male alumni could help elucidate any gender disparities and provide a more balanced understanding of the course's effects across gender.

The second set of limitations concerns the data collection method employed in the study. While interviews offer valuable insights into participants' experiences, perceptions, and reflections, they may not fully capture the nuanced and often subconscious impacts of experiences. Participants may struggle to articulate or recognize changes resulting from the course, potentially leading to an underestimation of its contribution to their professional life. However, it is essential to recognize that the absence of overtly expressed impacts does not necessarily negate the existence of subtle or indirect influences.

6 DISCUSSION AND CONCLUSION

This study illuminates the impact of the course "Collective Creation: Improvised Arts and Engineering" on alumni students, who consistently express deep appreciation for their experiences and emphasize the unique atmosphere and distinctiveness of the course. Remarkably, alumni predominantly recall the emotional and experiential dimensions of their participation, highlighting the course's holistic approach that goes beyond mere cognitive knowledge acquisition.

Surprisingly, the course emerges as a catalyst for student wellbeing, despite this not being its primary objective. This positive impact can be attributed to several factors. Within EPFL's academic environment, characterized by high levels of stress and pressure as reported by the Mental Health and Well-Being Survey of the EPFL community (Courvoisier et al. 2023), the Improgineering course seems to provide a liberating experience by providing students carte blanche, with no right or wrong answers and no pressure related to academic performance on standard test. Additionally, research suggests that activities promoting movement and creativity, central components of the Improgineering course, can alleviate stress and enhance wellbeing (Rodríguez-Jiménez et al. 2022; Tan et al. 2021; Tait et al. 2024). Moreover, the course facilitates social connectedness, a sense of belonging, trust and freedom, all of which contribute not only to student wellbeing but also to student retention, engagement and motivation (Pedler, Willis, and Nieuwoudt 2022; Strayhorn 2018; Allen et al. 2018).

The study also sheds light on the potential of improvisation and embodied practices for student engagement and transversal skills teaching. Indeed, the course, in alignment with embodied learning theories (see section 2 Theoretical groundings) fosters deep engagement and enhances memorability by involving the whole person.

The integration of improvisation and embodied practices also nurtures essential skills, such as collaboration, active listening, and creativity, which are often overlooked in traditional engineering courses (Daly, Mosyjowski, and Seifert 2014; Kovacs et al. 2020; Kazerounian and Foley 2007; Zhou 2012).

However, the study also underlines challenges in articulating the course's professional benefits. Participants cite barriers such as a lack of training in teamwork among other peers and colleagues, limited opportunities for application in professional settings, and discrepancies between the course content and the demands of engineering work.

The question thus arises as to whether a course, whose direct contribution to engineering education and one's later profession is unclear, has a place in the engineering curriculum. One can first note that the unclear direct contribution of the course to engineering may be related to engineering students lacking training in articulating what they have learned. Moreover, dismissing the value of the course solely based on its transferability overlooks its intrinsic benefits. The immediate impact and value students experience during the course are significant in themselves, reflecting a broader philosophy of education that transcends mere instrumental outcomes. Furthermore, challenges in transferring learning to other contexts may reflect systemic issues, such as a lack of environments and safe spaces conducive to deep listening and effective teamwork.

Additionally, while the course offers unique and enriching experiences, it is perceived by some participants as less "serious". This raises questions about what is considered serious in academia. In this case, it seems that less seriousness is in opposition to a certain rigidity of traditional courses since the course attendance is at about 80% which is relatively high, given the late timetable (16:30-19:00) and the remote location of the course (in a theater off campus site). Thus, we can wonder whether presenting the course as less serious is a way for certain participants of resolving the tension produced by the unconventional nature of the course, without questioning the rest of their studies.

More generally, an important secondary effect of the Improgineering course seems to be making students critically reflect on their engineering studies and work. It raises their awareness of how much they remain within an individualistic, cognitive, and rigid education system, both in terms of the work's format and the objectives to be achieved. The realization that none of this is necessary could be a major contribution of an unconventional course such as Improgineering in engineering education.

In conclusion, this study prompts a re-evaluation of conventional educational paradigms within engineering. It challenges us to consider the potential of integrating improvisation and embodied practices into engineering education. Rather than viewing the Improgineering course solely through the lens of its immediate applicability to professional settings, we must recognize its profound influence on student wellbeing, sense of belonging, creativity, and collaboration. As we contemplate the future of engineering education, we are compelled to ask: What if courses such as Improgineering were no longer the odd ones out but more mainstreamed in engineering education? How might this shift impact the way we engineer solutions to the complex challenges of our time? Would students become better engineers?

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