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► To cite this version:

Mathilde Yousefi, Stéphanie Fleck. Elements for understanding and tangibilizing emotional presence in a collaborative learning context. IHM'25 - 36e Conférence Internationale Francophone sur l'Interaction Humain-Machine, AFIHM; Université de Toulouse; ENAC, Nov 2025, Toulouse, France. <hal-05298836>

HAL Id: hal-05298836

<https://hal.science/hal-05298836v1>

Submitted on 6 Oct 2025

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Elements for understanding and tangibilizing emotional presence in a collaborative learning context

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Abstract

Socio-emotional skills are needed at every stage of life. The OECD praises them, and programs are in place to reinforce their development. These skills are particularly enhanced by collaborative group work, which involves more confrontation and negotiation between students. However, it is necessary to support this particular form of learning and to equip students and their teachers. This thesis aims to gain a better understanding of how socio-emotional interactions occur during collaborative sessions and to propose a tangible scaffolding tool to materialize the emotional state of a learning group to observe, on the one hand, how students might or might not, regulate their individual and group emotional states and on the other hand, the possible effects on collaborative and learning experiences. These participatory studies examined the needs, motivations, and fears of students and teachers regarding emotional sharing in a learning context. Collaborative creativity workshops have been conducted for this purpose. They raise pedagogical, moral, and technological issues and provide design leads through metaphorical ideations of the emotional state.

CCS Concepts

• **Human-centering computing**; • **Interactions design**; • **Collaborative and social computing**;

Keywords

Emotional presence, Tangible interactions, Design-Based research, Collaborative learning

Reference Format:

Mathilde Yousefi and Stéphanie Fleck. 2025. Elements for understanding and tangibilizing emotional presence in a collaborative learning context. In *IHM'25 : Actes étendus de la 36^e conférence Francophone sur l'Interaction Humain-Machine*, Novembre 3-7, 2025, Toulouse, France. , 4 pages.

1 Introduction

1.1 Context

1.1.1 Collaborative learning as a lever for personal development. The development of socio-emotional skills (e.g., empathy, regulation...) is a significant challenge, as supported by the OECD [29], in preparing citizens for today's challenges, particularly in collective decision-making. Promoting such learning represents a crucial lever for building a society based on mutual understanding and collaboration. Faced with these challenges, collaborative learning

methods appear to be the most relevant. Learning through collaboration (or collaborative learning) enables, among other things, to empower learners, develop a sense of community, improve communication skills [9], and contributes to the development of social and emotional skills. Among the various situations handled collectively, problem-solving and collective creativity tasks would generate more collaboration through the need to elaborate a shared definition of complex problems [7]. Indeed, it mobilizes specific behavioral patterns of interaction and synchronization [11], such as those identified by Dorta et al. [12], where questioning, negotiation, and decision-making behaviors alternate.

1.1.2 The Community of Inquiry. According to the inquiry community model [18], collaborative learning relies on the expression of different forms of presence, towards others or within the group. Sense of presence enables the group to share a common understanding of the problem and knowledge (cognitive presence). It shapes the sense of community and belonging (social presence). In a pedagogical situation, the role of a teacher/facilitator is also essential in structuring the task and supervising exchanges (pedagogical presence). Finally, a fourth type of presence: the emotional presence [5], remains overlooked [21]. Moreover, while the first three types of presence are often supported by the teacher or a technical system (collaborative platform, etc.) during collaborative learning, emotional presence is often neglected. However, support for this type of presence is essential because it enables the group to regulate its socio-emotional interactions. Helping to raise awareness of this type of presence is a strategic focus for optimizing collaborative dynamics. In this context, the primary objective of this thesis, grounded in a design-based research approach, is to propose a tool that makes emotional presence more tangible to better scaffold collaborative learning.

1.1.3 From absence to emotional presence supported by a tangible artifact. Many variables influence the level of emotional presence in a learning group [10, 11, 26]. Our first research objective is to better understand the contexts and factors that may trigger or inhibit the emergence of emotional presence behaviors and associated interactions. Through empirical studies, this will guide our design process and also lead to recommendations for educational uses of this type of support tool, better adapting to the complex interpersonal dynamics that fluctuate depending on the timing of the activity. Making an emotional presence tangible is complex and raises many challenges - technological, moral, and pedagogical - in a collaborative learning context. The question of the nature of the interface also arises. The choice of a mixed reality interface (TUI

or augmented objects) seems judicious. Indeed, unlike screens, it is shareable in the common social space and could facilitate new forms of collaboration [42]. Furthermore, the physical materialization of digital data makes abstract and complex information perceptible to the senses, supporting their awareness. A state-of-the-art analysis, drawing on multidisciplinary work in computer science, psychology, education science, and ergonomics, is being conducted to identify the most relevant input and output solutions.

1.2 State-of-the-art

Designing a tangible interface for awareness poses various challenges and questions. Indeed, can emotions be inputs? By "emotions", we mean "affective states", with affects being the subject of more elaborate cognitive processing [6]. However, capturing them poses technical and conceptual difficulties, as emotions are subjective and can be concealed. In learning situations, they are complex and nuanced [30]. The Pleasure-Arousal-Dominance model [34] thus enables us to place subtler emotional states. According to work in Affective Computing, it would be relevant to capture mixed data to transcribe an emotional state [38]. One of our objectives is to complete these measurements by identifying patterns of socio-emotional interactions. The question of the nature of output represents another issue. Numerous studies have shown associations between emotions to various feedback, including, among others, colors [23, 25], geometry and material density [24, 25] which seem to be the most widely used. In contrast, speeds [14], rhythms [17], and organic metaphors [24] or deformation remain under-explored. These variables would correlate with various states of the PAD model, providing design directions. Numerous studies have examined ways of conveying a sense of presence in various contexts, primarily within close relationships. Few interfaces were implemented in a professional context [4, 39] or a school context [3], and very few interfaces reflected a collective presence [22], with most focusing on individual forms of presence. The CORE database [41] identified interfaces and sorted them according to Hassenzahl's work [20]. This led to a categorization of design strategies adopted to conceive relational interfaces based on the type of interaction mediated by the interface (e.g., awareness, joint action, etc.). Of the 239 devices, 71 were selected for this state-of-the-art study. These devices were tangible and/or wearable objects that aimed to convey a presence through various embodiments and metaphors, echoing the above-mentioned associations. To date, we are unaware of any studies examining the effects of such a device on interpersonal dynamics in a learning environment.

1.3 Research questions

Given the limited research on this subject, the work currently ongoing investigates, on the one hand, how to support the learning of socially shared emotional regulation skills (SSeR) during collaboration and, on the other hand, the influence of nonverbal expression of affect, supported or not by a tangible user interface, on the dynamics of collaboration.

1.3.1 Objectives. O1. Adapt methods to identify the key components of socio-emotional interactions in collaborative learning. O2. Explore methods, forms, and metaphors for materializing emotional information through tangible prototypes. O3. Measure the effect of

expressing affects on emotional awareness and group dynamics in collaborative learning, with or without tangible interfaces.

1.3.2 Design-based research. This work employs a design-based research methodology [1] characterized by a transformative approach. The human-centered perspective involves future users (learners and teachers) throughout the process, which is conducted in three phases. An initial exploration phase reveals users' needs, expectations, constraints, and fears, enabling the design phase to begin by gathering ideas for possible prototypes (O2). The method employed here, notably through collaborative ideation workshops, allows us to observe interpersonal dynamics and the occurrence of socio-emotional behaviors (O1) to determine metrics measuring the prevalence of these behaviors across different variables. The design phase will also involve various intended users, and prototypes will be co-designed with students and teachers of technological disciplines. The prototypes will be tested, particularly with participants who have special needs (e.g., motor disabilities or neurodivergent development [37]), to ensure that the interface is relevant, useful, and usable. Finally, a comparative evaluation phase in a real-life context will reveal the effect of such an interface on socio-emotional dynamics, the development of socio-emotional skills, and the overall learning experience (O3).

2 Method

2.1 Procedure

Therefore, this research comprises several studies and has included six workshops: two semi-structured focus groups with individual ideation workshops, one autonomous collaborative ideation workshop, and three scripted collaborative ideation workshops using a card kit based on the double-diamond model. The idea was to compare these different modalities. The Emotional Regulation Difficulties Scale [8] and the Sense of Social Affiliation Questionnaire [33] were administered before and after the workshops, respectively. All participants completed a consent form before the workshop began. An online survey among university teachers was also launched to identify their pedagogical practices and propensity to introduce group or collaborative work, their perception of the socio-emotional dimension in lessons, and their attitudes towards a potential tangible scaffolding tool. However, this paper focuses solely on the workshops.

2.2 Participants

The studies involved 22 students from human sciences, organized into groups of 4 to 6 people who knew each other beforehand. The participants came mainly from Master's programs in psychology, ergonomics, and educational engineering. Among them, three students self-identified as neuroatypical and/or with motor disabilities.

2.3 Data capture and analysis equipment

The verbatim were selected according to the relevance of the content, which evoked a design idea, a need, a constraint, a feeling, or a statement related to emotional sharing and what follows from it. Unclear, incomplete, and off-topic utterances were not included in the textual analysis carried out on Iramuteq [32]. An observation grid is currently being refined to study manifestations of affective

expression through non-verbal cues derived from models (SSRL [19], FRECL [26]) and studies [27, 28, 35]. The number and duration of exchanges will also be taken into consideration.

3 Discussed results

3.1 Design spaces

To date, only the first three workshops have been transcribed. These identified the main properties of the interface through three overlapping design spaces [36] : pedagogical, moral, and technological. The principal axes discussed the pedagogical and moral aspects, including the perceived usefulness of the envisaged artifact, associated concerns, the question of emotional privacy, whether to share a real-time state, and whether to have a collective or individual interface. Regarding technology, participants discussed the type of output, the most appropriate moment for its occurrence, how to categorize emotional states, their baselines, and the types of support. Throughout the readings, several taxonomies aimed to categorize mixed reality interfaces stand out. Some take a technocentric approach [15, 31, 40], while others are more human-centric [20]. Fleck [16] has already distinguished tangible continuums of perception, action, and support. Another aim of this thesis is to develop and refine this work further to harmonize classifications.

3.2 Interpersonal dynamics

An initial analysis of interpersonal dynamics shows a difference between the semi-directive focus groups and the autonomous collaborative ideation workshop. The latter increased the number of various interactions between participants. The behavioral coding currently in progress will enrich this analysis. Several factors influence the collaborative experience through differences in emotional expression. We can cite individual [10], collective [26], and socio-cultural differences (e.g., gender [2, 13]), as well as differences linked to the structuring of the task or activity [11].

3.3 Future works

Future work will involve coding behaviors and linking them with questionnaire scores. It will also include comparing our workshops according to the previously identified variables. The design phase began in September and is based on ideas for prototypes from participants' comments and the literature. To improve collective creative processes and adapt design choices to our target audiences, personas will be created based on comments collected during our exploration phase (during the workshops and from the survey) and after transcription and textual analysis using Iramuteq software.

4 Acknowledgments

This work is financially supported by the Numerical Collaboration Research Program (PEPR eNSEMBLE - PC1 & 5), financed by France 2030 and piloted by CNRS, Inria, Université Grenoble Alpes, and Université Paris-Saclay.

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