

Human-Machine Collaboration in Emotionally Responsive Teaching Practice

Amelia Ijiri ¹, Lynsey Mori²

University/Organization: Kyoto University of Foreign Studies ¹, Ritsumeikan University²

Authors' Email ID(s): A_ijiri@kufs.ac.jp ¹, lynseymo@fc.ritsumei.ac.jp ²

ORCID ID(s): 0000-0002-2266-9499¹, 0000-0003-2640-2326 ²

*Corresponding Author: a_ijiri@kufs.ac.jp

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ABSTRACT:

Emotional analytics tools are increasingly embedded within educational platforms, yet their pedagogical value depends not on the data they generate but on the relational conditions in which that data is interpreted. This study examined relationships among seven dimensions of socio-emotional experience: emotional awareness, relational belonging, engagement, purpose, teaching climate, SEL strategy use, and perceived usefulness of Microsoft Reflect, in a university English-medium instruction context in Japan (N = 89), following a three-week classroom implementation. Using a quantitative correlational design and a SEL–Reflect survey, results revealed that Teaching Climate demonstrated the strongest pattern of positive associations across all subscales, while Emotional Awareness alone showed no significant relationship with Reflect Usefulness. These findings suggest that emotional self-awareness does not, by itself, make emotional analytics educationally valuable; rather, their value depends on the quality of classroom relationships and teachers' capacity to interpret affective data within its relational and pedagogical context. This has particular relevance for students managing anxiety or social-emotional difficulties, for whom a responsive teaching climate may be a precondition for meaningful engagement with emotional self-report tools. Positioning teachers as central agents within human-machine hybrid teams, we argue that emotional analytics function most effectively as cognitive and relational scaffolds that extend professional judgment rather than automate educational decision-making. The study contributes to discussions of teacher agency, emotionally responsive pedagogy, and the ethical integration of emotional analytics in higher education.

Keywords: emotional analytics, social emotional learning, teacher agency, Microsoft Reflect, human-machine collaboration

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Introduction

The integration of emotional analytics into educational environments raises fundamental questions about the relationship between data

and professional judgment. As digital platforms become increasingly capable of aggregating and visualising student affect in real time, educators face a growing tension: how to use data-rich tools responsibly without reducing the complexity of

classroom emotional life to measurable indicators, a risk that is especially high for students managing anxiety or social-emotional difficulties whose distress may not be visible through ordinary observation [1,2,3,4]. Tools like Microsoft Reflect address this directly, aggregating anonymised student self-report data through a shared dashboard to surface emotional patterns that individual observation alone may miss [5,6,7,8].

This study positions teachers as central agents within human-machine hybrid teams, arguing that emotional analytics can support teachers' emotional attunement, ethical judgment, and responsibility for classroom climate and students' emotional regulation. Rather than replacing professional expertise, this division of labour reflects complementary strengths: digital tools support aggregation and pattern visibility, while educators retain responsibility for interpretation, contextual understanding, trust, care, and relational repair [9,10,11]. We treat affective data visualized through emotional analytics as provisional and interpretive rather than diagnostic. Such tools function as resources that invite professional judgment, not substitute for it.

The present study investigates the relationships among seven dimensions of students' socio-emotional experience in a university English-language learning context in Japan, as measured by the SEL-Reflect survey. The findings suggest that Teaching Climate showed the strongest pattern of associations across subscales, while Emotional Awareness alone shows no significant relationship with Reflect Usefulness, meaning that data without relational context does not translate into perceived value. We argue that the value of emotional analytics lies not in automating pedagogical decision-making, but in extending teachers' capacity to notice, interpret, and respond to the emotional dynamics of the classroom, including for students whose difficulties might otherwise remain unseen.

Methodology

Participants and Setting

Participants were 89 university students enrolled in English as the medium of instruction in business and digital literacy courses at two private

universities located in Kyoto, Japan. Although 100 students initially enrolled across the two institutions, 11 responses were excluded from analysis due to incomplete survey data, resulting in a final analytic sample of $N = 89$. Participants represented a range of English proficiency levels spanning CEFR A1/A2 to B1/B2 and were studying content delivered through English as the medium of instruction. All participants were adults who provided informed consent prior to the study. Participants were explicitly advised that involvement was voluntary, that withdrawal was possible at any stage without academic penalty, and that participation would have no bearing on their course grade. Data were fully anonymized prior to analysis and stored securely in accordance with institutional research ethics guidelines.

Instruments

To ensure the survey instrument accurately captured the intended socio-emotional and educational dimensions, the items were systematically aligned with established theoretical frameworks and validated scales. Table 1 details the specific constructs measured, their corresponding item numbers, and their conceptual grounding. Foundational frameworks adapted for this study include the Positive and Negative Affect Schedule (PANAS) [12]; for emotional regulation, the University Classroom Social Climate Scale (CSCS-U) [13]; for relational belonging and community awareness, and the Classroom Climate Questionnaire (CCQ); [14] for pedagogical climate and engagement. Context-specific items not derived from standardized instruments such as those evaluating the perceived usefulness of Microsoft Reflect, qualitative reflections, and general technology preferences, were added to the survey by research/ practitioners.

Procedure

The study employed a pre-post survey design embedded within a three-week classroom intervention. Prior to the intervention, participants completed a pre-intervention survey designed to establish baseline measures of emotional awareness, belonging, engagement,

and related socio-emotional constructs. During the intervention period, both teachers administered Microsoft Reflect via institutional Microsoft Education accounts at the beginning of each 90- or 100-minute class session. Reflect prompts invited students to self-report their current emotional state; aggregated, anonymized responses were then made visible through a shared dashboard accessible to both teachers and students. Both instructors followed an identical implementation protocol, using dashboard data to prompt check-in conversations, peer-buddy suggestions, and classroom norm discussions. Following the three-week period, participants completed the post-intervention survey in a single sitting lasting approximately 10–15 minutes. The current study is part of an ongoing programme of research; a prior study examining Microsoft Reflect in a comparable university context served as a pilot study informing the present research design [15].

Survey Items

All survey items were translated into Japanese by the research team to ensure linguistic accessibility for participants with CEFR A1 to B2 English proficiency levels; human translation procedures were used to verify conceptual equivalence. All SEL, emotional awareness, belonging, engagement, and classroom-climate items were administered using a four-point Likert scale (1 = Strongly disagree, 4 = Strongly agree). A four-point structure was selected for three methodological reasons. First, forced-choice scales reduce the well-documented central-tendency bias associated with midpoint categories, encouraging respondents to take a clearer evaluative position on socio-emotional constructs. Because the present study adapted items conceptually from established instruments (PANAS for momentary affect, CCQ for classroom climate, and ECSA-U for relational norms) rather than administering the original scales directly, the response format was optimized for feasibility, clarity, and cognitive load within a weekly classroom check-in procedure. The four-point design ultimately supports higher interpretive validity for SEL constructs in instructional settings, while

maintaining psychometric rigor appropriate for short-form affective inventories. Reliability analyses for each subscale (reported below) indicate that the four-point structure produced stable and internally consistent responses suitable for inferential analysis in classroom-based SEL research.

Data Analysis

Quantitative data were analysed using IBM SPSS Statistics (v. 28). Descriptive statistics, including means, standard deviations, and subscale reliability estimates, were computed for each of the seven subscales to characterise the sample's socio-emotional profile and confirm internal consistency. A significance threshold of $p < .05$ (two-tailed) was applied throughout. Before conducting Pearson's correlation, histograms were examined to assess whether the variables were approximately normally distributed. Scatterplots were also inspected to confirm a linear relationship between the variables and to identify any obvious outliers.

Results

Descriptive Statistics and Reliability

Descriptive statistics and reliability estimates for the seven SEL–Reflect subscales are presented in Table 1. Subscale means ranged from 2.66 (SEL Techniques / Transfer) to 3.37 (Relational Belonging) on a four-point scale, indicating generally moderate to high endorsement of socio-emotional competencies and classroom climate. Internal consistency estimates were acceptable to excellent across most subscales ($\alpha = .57-.84$; $\omega = .76-.90$). Relational Belonging ($\alpha = .84$, $\omega = .90$), Engagement & Learning ($\alpha = .81$, $\omega = .88$), Teaching Climate ($\alpha = .78$, $\omega = .86$), SEL Techniques / Transfer ($\alpha = .77$, $\omega = .86$), and Reflect Usefulness ($\alpha = .81$, $\omega = .88$) demonstrated strong reliability. Emotional Awareness ($\alpha = .57$, $\omega = .76$) and Purpose & Community Awareness ($\alpha = .57$, $\omega = .82$) returned more modest alpha coefficients; however, this is expected given the small number of items comprising each of these subscales (four and two items, respectively), and McDonald's ω values indicated acceptable construct reliability for both.

Table 1: Descriptive Statistics and Reliability Estimates for SEL–Reflect Subscales (N = 89)

Subscale	Items	M	SD	Cronbach's α	McDonald's ω
Emotional Awareness (Q3–Q6)	4	2.85	0.55	.57	.76
Relational Belonging (Q7–Q9)	3	3.37	0.89	.84	.90
Engagement & Learning (Q10–Q13)	4	3.05	0.68	.81	.88
Purpose & Community Awareness (Q14–Q15)	2	2.89	0.65	.57	.82
Teaching Climate (Q16–Q19)	4	3.17	0.65	.78	.86
SEL Techniques / Transfer (Q20–Q23)	4	2.66	0.79	.77	.86
Reflect Usefulness (Q24–Q27)	4	2.81	0.68	.81	.88

Note. All items rated on a four-point Likert scale (1 = Strongly disagree, 4 = Strongly agree). Means represent subscale averages.

Interpreting the Findings

Contemporary cognitive science offers a useful frame here. Human cognition is not bounded by the skull; thinking extends outward into the body, physical and social environments, tools, relationships, and observational practices that surround and support it [16, 17]. For teachers, this means that professional judgment is never exercised in isolation. Teachers think with their students, their classrooms, their accumulated experience, their emotional intuition, and their observations over time. Together, these form a distributed system of professional cognition that supports pedagogical judgment. Understood in this way, Microsoft Reflect does not introduce a new category of information so much as it adds one more channel through which classroom affect becomes visible. It extends the teacher's perceptual reach. It does not replace professional thinking; it gives that thinking more to work with.

This framing helps explain why Emotional Awareness alone showed only a weak relationship with Reflect Usefulness in the present data. Awareness of one's emotional state is necessary but insufficient. What transforms awareness into meaningful action is a relational

context in which that awareness can be expressed, received, and responded to, shaped above all by the quality of the teaching relationship [18, 19, 20]. Students did not find the tool useful simply because they were emotionally self-aware; they found it useful when they felt the classroom was safe and supportive enough to make self-disclosure worthwhile. The pedagogical value of the tool was therefore derived not from the technology itself, but from the quality of the human relationships within which it was embedded.

This also has implications for how emotional data should be read, and what it cannot tell us. A student's low belonging score, flat affect, or pattern of disengagement is always an incomplete signal. Emotional responses are shaped by prior experience, cultural background, and personal history in ways that aggregate data cannot surface or contextualise [21]. What a dashboard registers as disengagement may be caution, cultural reserve, cognitive overload, or something entirely unrelated to the classroom. The data point exists; its meaning does not. That interpretive gap is not a flaw to be engineered away; it is the permanent condition of working with human beings, and it is precisely the space where teacher judgment,

relational knowledge, and professional care become indispensable.

The findings of this study therefore suggest that emotional analytics should not be conceptualised as autonomous educational technologies, but as cognitive and relational scaffolds that extend teachers' professional judgment. Rather than automating care, these systems increase the visibility of classroom affect while preserving the ethical, interpretive, and relational work that remains uniquely human. This is, at its core, a question of care.

Care is not a sentiment but a practice, one that requires presence, attentiveness, and response to the particular needs of the particular people [22,23]. Emotional analytics can support the first of these; the second and third remain irreducibly human. The teacher is not replaced by the data; the teacher is better equipped by it, provided the relational and institutional conditions exist to support that kind of thoughtful, situated response.

Conclusion

The broader implication is that emotional analytics should be understood not as autonomous decision-making systems but as cognitive and relational scaffolds that extend teachers' professional judgment. They make more visible what skilled teachers have always tried to attend to: how students are feeling, whether they feel safe enough to say so, and what kind of support might help. The tools that serve education best will be those designed to augment that human capacity, not replace it.

Future research should explore cross-cultural variation in emotional self-disclosure, longitudinal effects of sustained Reflect use, and the conditions under which emotional analytics genuinely support, rather than surveille, student wellbeing. As these systems become increasingly embedded in educational technology, the challenge is no longer whether machines can recognise emotion, but whether they can support the distinctly human work of interpreting, responding to, and caring for the people behind the data.

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