INNOVATION IN LANGUAGE LEARNING International Conference

Emotional Responses to AI Tutors in Young Learners: A Sociocultural Perspective on Trust, Motivation, and Frustration

Tatiana Kozlova

Sapienza University of Rome, Italy

Abstract

This study explores EFL young learners' emotional responses to AI tutors through the lens of Vygotsky's Sociocultural Theory, focusing on how trust, motivation, and frustration emerge in mediated learning environments. Framing AI-tutors, as quasi-social agents, the research examines how they mediate between students and learning context, particularly in relation to the Zone of Proximal Development (ZPD). The study involves Grade 5 and Grade 6 pupils in a bilingual Italian school in Rome. Using questionnaires and qualitative analysis of student interactions with AI-powered tutors on the SchoolAI platform, the study investigates how learners perceive AI support, and whether these perceptions reflect effective scaffolding within their ZPD. Emotional responses are interpreted as signals of alignment between AI support and learners' developmental readiness: motivation and trust suggest effective scaffolding, while frustration may point to mismatched support. The findings contribute to our understanding of how AI can serve as a culturally shaped, emotionally responsive tool in education, mimicking aspects of human scaffolding. The study emphasizes that emotions are not peripheral to learning, but central to cognitive development, especially when mediated by AI in socially and developmentally meaningful ways.

Keywords: *Young learners, Vygotsky's sociocultural theory, ZPD, scaffolding, AI tutors, emotional responses*

1. Introduction

The increasing integration of AI-powered tutors into language education raises important questions about their role in shaping young learners' developmental trajectories. While recent studies have highlighted the potential of AI in enhancing language learning outcomes [4], [5], [21], much of this research remains focused primarily of cognitive gains and knowledge acquisition, with limited attention to the broader developmental and emotional aspects of learning.

This study draws its theoretical and methodological foundation from the critical realism of Bhaskar [1], [2], which adopts a stratified depth ontology encompassing three levels of reality: the empirical (what is observed), the actual (what happens regardless of observation), and the real (the deep structures and causal mechanisms that generate events and experiences). Drawing on Bhaskar's depth ontology, this study advocates for a shift in perspective – from analyzing surface-level interactions between learners and AI systems to uncovering the underlying cognitive and emotional mechanisms at play, thereby critically engaging with how AI-mediating learning environments shape the learner's inner world.

Through the lens of Vygotsky's Sociocultural Theory (SCT) and its application to second language development [9], [10], [11], we are better positioned to explore these deeper dimensions. SCT conceptualizes learning as a socially mediated process in which tools play a central role in cognitive and emotional development. Although a growing body of research [6], [7], [12] has begun to extend SCT to AI-mediated learning, its application to young learners' interaction with AI remains underexplored.

Focusing on English as a Foreign Language (EFL) instruction in a bilingual Italian primary and lower secondary school, this research aims to answer the following questions:

-How do young learners emotionally respond to AI tutors?

-What do these responses reveal about AI's role in scaffolding within the Zone of Proximal Development (ZPD)?

In addition to presenting empirical findings, the study aims to offer a theoretical contribution to the understanding of AI-mediating learning.

2. Theoretical Framework

Recent studies have increasingly recognized that AI systems do more than just deliver instructional

content - they actively mediate emotional and cognitive engagement in learning process [16], [24]. While much of this research focuses on the empirical and interactional dimensions of affect in AI-mediated learning (what emotions are induced), this study advocates for a deeper ontological approach. Specifically, it draws on Bhaskar's critical realism theory to argue that emotional responses observed in AI-supported environments point to underlying causal mechanisms (such as emotion-cognition integration and culturally-mediated self-regulation) that shape how learning actually unfolds.

Central to this argument is Vygotsky's Sociocultural Theory, particularly its lesser-explored concept of *perezhivanie* (often translated as "emotional experience"). Vygotsky [20] posits a dialectical relationship between an individual and the environment, asserting that development is not determined by the environment itself but how it is experienced and interpreted by the learner. *Perezhivanie* refers to the unified emotional and cognitive interpretation of the situation. This concept resonates in AI-mediated learning environments, where students' reaction to tasks, feedback, and interactional tone are deeply affective as well as cognitive. From this perspective, the effectiveness of AI tutors cannot be assessed solely by measuring learning outcomes or task performance. Rather, it must be evaluated in terms of how students experience the interaction emotionally, how they feel challenged, supported, or alienated in relation to their ZPD. As Vygotsky [18] defines it, ZPD represents the distance between a learner's current developmental level and their potential development under guidance. Successful scaffolding within the ZPD should evoke productive emotional states such as curiosity, motivation, confidence. Conversely, ineffective or poorly timed scaffolding may lead to confusion, frustration, or disengagement.

This perspective is increasingly reflected in emerging research. For example, Yang and Zhao [23] document a wide range of emotional responses in EFL learners interacting with AI-tutors, highlighting both positive engagement and emotional strain, as well as strategies learners employ to self-regulate. Their findings point to the need for further exploration of the affective consequences of AI-mediation in L2 learning. The current study responds to this call by analyzing young learners' interactions with AI through the lens of *perezhivanie,* ZPD, and critical realism.

Furthermore, this study draws on Wood *et al.* [22] concept of the tutorial process to analyse the "quasi-social" nature of AI-learner interactions [17]. Since the seminal work of Reeves and Nass [14], which demonstrated that people often respond to machines as if they were social beings, the conceptualization of more recent AI tutors has evolved into that of "quasi-social" agents and "interaction partners" in a certain limited sense [17]. AI tutors, although, not sentient, mimic human scaffolding behavior: they respond to learner input, adjust task difficulty, and provide feedback. As such, they function as mediating artefacts in the Vygotskian sense, that shape learner's engagement with the world. Yet, unlike human teachers, AI systems lack true emotional intelligence or ethical judgement [13], raising important questions about their capacity to fully support emotional development. Contemporary sociocultural research [15] reinforces the view that emotions are not private, isolated states, but socially constructed and contextually mediated experiences. In AI-mediated learning, emotional signals (motivation, enthusiasm, trust, frustration, confusion, resistance) can therefore be seen as diagnostic tools: they reveal the degree to which the AI is effectively mediating within each individual's ZPD, i.e. how learners interpret and internalize AI's guidance and the broader learning situation.

2.1. Stratified Reality in AI-mediated Learning

To visualise the multi-layered reality of AI-mediated learning, the following table integrates Bhaskar's stratified ontology with Vygotsky's sociocultural concepts.

Table. 1 Stratified Reality in AI-Mediated Learning

Ontological level	**Description**	**Application in AI Learning**	**Learner–AI interaction scenario**
Empirical	observed events / experiences	Learner's experience of AI system	The student shows signs of frustration, which are detected by the AI tutor (e.g., through response latency, error patterns, or selected emotional indicators).
Actual	events that occur, even if not observed	Hidden algorithmic operations	In response, the AI adjusts the difficulty level of the task, simplifies instructions, or provides additional scaffolding.

Real	underlying mechanisms / structures	*perezhivanie*	Underlying these observable interactions are deeper mechanisms such as the learner's emotional-cognitive integration, capacity for self-regulation, and the cultural or experiential framing of the task *(perezhivanie).*

This framework positions *perezhivanie* within the "real" domain - an underlying structure that helps explain why, as empirical findings of this study will demonstrate, similar instructional interventions lead to divergent outcomes across learners. For example, two students receive the same adaptive feedback within their ZPD, but due to differences in their emotional histories or perceived relationships with AI, one responds with curiosity and motivation while the other experiences frustration and disengages from the task.

3. Research Design

3.1. Participants and Setting

This study was conducted at St. Philip School, a bilingual Italian primary and lower secondary school institution located in Rome. The participants included 34 students from Grade 5 (n=16) and Grade 6 (n=18), aged between 10 and 12 years. The study was integrated in regular curricular classes in English as a Foreign Language (EFL), as well as Content and Language Integrated Learning (CLIL) History and Art Classes. All participants had prior experience using digital tools in the classroom. The school was selected due to its balanced integration of traditional teaching methods and digital technologies. Ethical approval was obtained from the institution, and written informed consent was secured from parents. Participation was voluntary, and students were informed of their right to withdraw at any point.

3.2. AI Platform

Students engaged with AI-tutors through SchoolAI, a web-based educational platform that offers adaptive support across various curricular subjects. The platform simulates dialogic interaction by providing real-time, tailored feedback and task-based scaffolding, thereby aligning with principles of dialogic pedagogy. It protects student data with bank-level security and holds SOC 2 Type 2 certification. The platform complies with major data protection regulations such as FERPA, COPPA, and 1EdTech standards.

3.3. Learning Task

The learning task was designed to be both cognitively challenging and emotionally engaging. It aimed to assess student's subject knowledge while promoting sustained interaction with AI tutor to expand their understanding of the topics studied in class with their teacher. To this end, the chatbot-based tasks were created, aligned with the students' current curriculum. For primary school students, the chatbot interactions were centered on Roman history (CLIL History); for lower secondary students, they focused on Leonardo da Vinci's artworks (CLIL Art) and Anglo-Saxon culture (EFL classes). Students were required to respond to the AI-tutor's prompts and questions in real time in dialogic exchanges that mirrored teacher-led institutional practices. Each student interacted with the same AI-tutor once a week for 30 minutes over a four-week period.

3.4. Data Collection

A mixed-method approach was adopted to capture both emotional responses and interactional patterns. The following instruments were used:
-Emotion questionnaires: After each AI session, students completed a self-report questionnaire assessing emotional states such as trust, motivation, engagement, confusion, and frustration. Responses were recorded using a 5-point Likert scale and supplemented by short open-ended reflections.
- Focus groups: Post-treatment focus groups were held with pupils to supplement the questionnaires and clarify the ambiguities that emerged from open-ended reflection. The discussions were semi-structured and notes were taken for further elaboration.

- Classroom observations: The researcher conducted non-intrusive observations during lessons, focusing on students' verbal and non-verbal behaviours while interacting with AI. Field notes were used to document indicators of emotional engagement or disengagement.
- Interaction corpus: A purpose-built corpus was compiled, comprising written interactions between learners and the AI tutors on the SchoolAI platform. Dialogues were analysed qualitatively to examine how students responded to various scaffolding strategies and how their emotional responses evolved over time.

3.5. Data Analysis

Qualitative data from the emotion questionnaires were analysed using thematic analysis [3] to identify patterns in emotional responses across sessions. The coding process was both deductive, drawing on key constructs from SCT (scaffolding, ZPD alignment), and inductive, allowing for emergence of unanticipated themes. Triangulation across data sources was employed to enhance the credibility and depth of findings. This approach enabled a detailed understanding of how learners' emotional responses were shaped by, and in turn shaped their interactions with the AI tutor.

4. Findings

Consistent with sociocultural perspective that view emotion and cognition as inseparable [19], this study found that positive emotional responses (engagement, trust and motivation) were strongly associated with moments when AI scaffolding was well-aligned with learners' ZPD. Students trusted the AI when it provided feedback that was supportive and attuned to their perceived needs. Similarly, motivation was highest when students encountered challenge within reach - a key condition for learning in the ZPD.

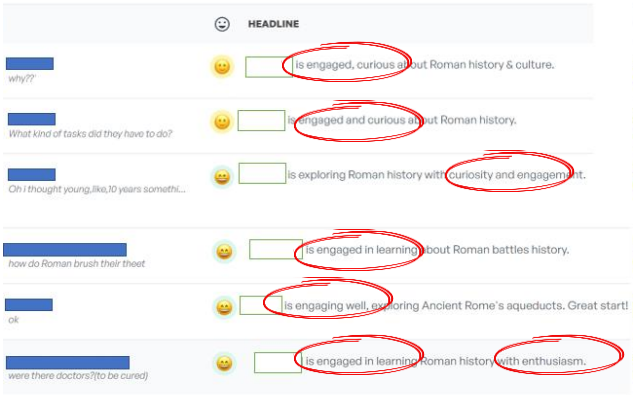

Fig. 1. An example of the way AI-platform detects learners' motivation

The responses illustrated in Figure 1 mirror the dynamics typically observed in effective human mediation, with AI tutor being able to perform the key functions of a successful mediator as outlined by Wood *et al.* [22]:
1. Recruitment.
2. Reduction in degrees of freedom.
3. Direction maintenance.
4. Marking critical features.
5. Frustration control.
6. Demonstration.

Despite generally positive responses, frustration emerged as a recurring emotion among some students. 18% of the students reported feeling "confused" or "annoyed" during certain tasks. In these instances, purpose-built corpus of learners' interactions revealed that frustration was frequently manifested by inputting random characters (e.g. "`1234567890-=][poiuytrewqasdfghjkl;'#'/.,mnbvcxz\") or using inappropriate language. It sometimes happened when AI-tutor tried to elicit a personal response from a student (e.g. by asking "What do you think?"). As one student noted in the open-ended reflection of his questionnaire "it's a computer program. why does it care about my opinion?". This remark underscores the ambivalent nature of the AI's "quasi-social" dimension, which, while often

generating curiosity and excitement, also provokes frustration; at the end of the day the pupils are aware of dealing with a computer program. Although the learners' tendency to anthropomorphise tutors has been well documented, the implications of such anthropomorphisation need to be further investigated.

In addition, it must be highlighted that despite the apparent engagement, the majority of interactions presented deviations from the assigned topic, which were sometimes brief, sometimes more persistent. The learners were chatting excitedly with tutors but were they actually learning what they were supposed to learn? Direction maintenance is one of the functions of the tutor in the scaffolding process [22]. Consequently, AI tutors repeatedly attempted to redirect learners to the topic of the lesson. As the corpus analysis revealed, frustration often emerged as a reaction to such redirection. The learners might have felt deprived of their agency to steer the conversation in a direction of their own choice.

Frustration appeared especially pronounced in students with lower linguistic level when the AI introduced vocabulary or grammatical structures beyond the learner's current capability without appropriate support – an indication of misalignment with the ZPD. An example of such misalignment can be seen in Figure 2.

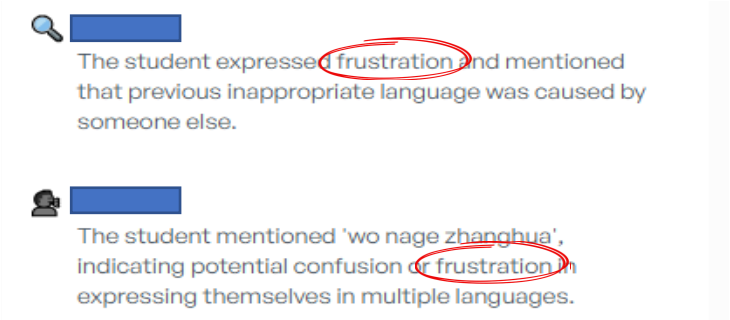

Fig. 2. An example of the way AI-platform detects manifestations of frustration

The mismatched support might also be associated with the "mid-phase of learning" in which individualized teaching may be most difficult to realise because "there are often too many complexities for either man or machine programmes to take into account" [22]. "Given the "disordered" structure of this mid-phase one cannot always know that a child is in fact simply ignoring a suggestion, whether he is systematically misunderstanding it or what. To the extent that the learner is at sea, so too is the tutor, who faces difficulties in interpreting responses appropriately" [22]. In any case, frustration emerged as a clear marker of misalignment between AI's assistance and learners' developmental level. When the AI failed to interpret learner input or offered input that was perceived as unhelpful or confusing, or too easy and uninspiring, students expressed disengagement and irritation. From a sociocultural standpoint, these breakdowns reveal the limits of current AI systems in sustaining intersubjective understanding, a foundation aspect of learning mediation. While temporary frustration can be a natural part of productive struggle, its persistence without resolution suggest a failure in scaffolding within ZPD. Unlike human teachers, who know the learners' background, can read body language, ask clarifying questions, and flexibly shift strategies, AI tutors currently lack the capacity to interpret social and emotional cues. This limitation risks turning AI from a supportive tool into a source of alienation, especially for young learners, compromising their self-esteem, emotional security and learning engagement in the long-term run.

5. Discussion

The findings of the study indicate that AI tutors, such as those embedded in the SchoolAI platform, are becoming increasingly effective at adapting to students' performance levels and approximating their ZPD. Students generally responded well to AI scaffolding, and emotion questionnaires showed moderate to high levels of engagement across sessions. However, triangulated data (especially written reflection and observation notes) suggest that alignment between students' emotional states flagged by the AI-system and emotions reported by students themselves was inconsistent. The misalignment points to an important disjunction between surface-level interactional success and underlying emotional experience.

5.1 Theoretical Interpretation: ZPD and Perezhivanie

While the ZPD provides a useful framework for understanding how AI can support task performance, it does not fully capture how learners emotionally interpret and internalise these interactions. Vygotsky's concept of *perezhivanie* - the personal emotionally saturated experience of a situation - helps illuminate this gap. Students receive the same type of support within their ZPD, yet engage with it in very different ways, depending on prior experiences, self-confidence, cultural values, or emotional readiness. One student, for example, was flagged by the system as "actively engaged", yet described the AI's exaggerated praise as "fake", writing: "AI should be a little onest because he always say: "Fantastic, wonderful, amazing! And it sound really fake" [original spelling preserved]. This illustrates a disjunction between algorithmic evaluation and lived emotional experience, which can influence future motivation and learning disposition.

This variation aligns with Vygotsky's insight: "The emotional experience [*perezhivanie*] arising from any situation or from any aspect of the environment, determines what kind of influence this situation or this environment will have on the child. Therefore, it is not any of the factors in themselves (if taken without reference to the child) which determines how they will influence the future course of his development, but the same factors refracted through the prism of the child's emotional experience [*perezhivanie*]" [20]. Thus, while AI may scaffold tasks within the ZPD, it does not necessarily foster the positive *perezhivanie* required for developmental change.

5.2 A Critical Realist Perspective

These findings gain further depth when examined through Bhaskar's depth ontology, described in the second section of this paper. In this study, the AI platform operates effectively at the empirical and actual levels, adjusting based on observed input and output. However, the students' varied emotional reactions and the mechanisms behind them exist at the real level, where deeper socio-emotional and cultural factors shape learning engagement. By framing *perezhivanie* as a mechanism within this deeper stratum, we begin to understand why some students thrive with AI support while others withdraw or remain emotionally disengaged, despite similar scaffolding. This calls for a broader conception of adaptive learning – one that attends not only to performance but also to the emotional resonance of the learning experience.

5.3. Implications for AI-mediated Educational Practice

These insights suggest that for AI to function as a genuinely effective educational tool, it must evolve beyond functional adaptation to include sensitivity to learners' emotional meaning-making. Emotional transparency, perceived authenticity, and responsiveness must become integral components of AI design, particularly if such tools aim to support deeper forms of leaning and development, not just task completion. For educators and designers of AI platforms, integrating emotional responsiveness into AI-mediated learning does not mean simulating emotions superficially, but rather ensuring that AI systems can offer developmentally appropriate, adaptive scaffolding that supports not just cognitive goals but also emotional needs. Teachers also play a crucial role as co-mediators in AI-rich classrooms. They can observe students' emotional cues, step in when AI scaffolding breaks down, and help learners reflect on their interaction with AI as part of a broader metacognitive and social learning process.

6. Conclusion

This study contributes to the growing body of research that positions AI within the sociocultural and affective dimensions of learning. Focusing on young EFL learners, it examines how students emotionally respond to AI tutors and how these responses reflect the quality of scaffolding provided within their ZPD. While current AI systems demonstrate considerable sophistication in modelling ZPD through adaptive scaffolding, the findings suggest that they often fall short in recognizing and responding to learners' subjective emotional experience. By drawing on Vygotsky's concept of *perezhivanie*, the study highlights the importance of understanding how students internalise and emotionally interpret AI-mediated learning interactions. These affective dimensions play a crucial role in determining whether the potential embedded in the ZPD is effectively realised. Integrating this perspective with Bhaskar's critical realist ontology allows for a deeper exploration of the hidden mechanisms - beyond observable behaviour – that shape learning outcomes.

In sum, meaningful learning in AI-supported environment requires more that cognitive adaptation; it demands attention to the emotional and experiential depth of the learner's engagement.

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