Warmth or Competence? Efficacy of Adaptive AI Chatbots Based on the Stereotype Content Model in Nonviolent Communication Education

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Abstract: *Traditional large-class instruction often struggles to provide individualized guidance for students facing emotional distress and lacking social awareness. This study integrates the Stereotype Content Model (SCM) and Aptitude-Treatment Interaction (ATI) theory to construct a generative AI tutoring system with an "implicit adaptive matching" mechanism designed for Nonviolent Communication (NVC) education. The NVC framework proposed by Rosenberg (2003) offers an effective intervention, and this pilot study examines the learning outcomes of the two experimental conditions (a baseline AI vs. the adaptive AI) with 16 graduate students (ages 22-27). Due to the extremely small sample size, non-parametric tests were used. Preliminary results show that the adaptive AI system possesses high usability and demonstrates potential in facilitating knowledge transfer in the Situational Judgment Test (SJT). Qualitative log analysis reveals that facing a single, standardized AI, participants exhibited cognitive fatigue and passive withdrawal. The findings empirically demonstrate the limitations of single-style AI and highlight the need for introducing "warmth-oriented" and "competence-oriented" AI for implicit shunting. This study validates the theoretical framework and confirms that the system effectively prevents empathy fog, laying a solid foundation for future computer-supported collaborative learning before scaling the intervention to adolescent populations.*

Keywords: Collaborative Learning, Generative AI, Nonviolent Communication (NVC), Personalized Learning, Stereotype Content Model (SCM)

1. Introduction

Adolescents' rapid limbic system development often outpaces prefrontal cortex maturation, leading to a lack of social awareness and a tendency to use aggressive "jackal language" during conflicts. While the Nonviolent Communication (NVC) framework proposed by Rosenberg (2003) offers an effective intervention to move beyond habitual judgment and build authentic connections, its implementation in traditional large-class settings faces a dual dilemma. First, teachers struggle to provide sufficient emotional scaffolding and individualized guidance. Second, public role-playing exercises often trigger peer social anxiety, causing defensive mechanisms that render practice superficial. Generative AI offers a new intervention opportunity by creating a safe, non-judgmental "digital transitional space." Recent empirical studies indicate that developing adolescents particularly need AI to provide "emotion normalization" and a private space for emotional practice (Lee et al., 2025). However, general-purpose AI often adopts a "one-size-fits-all" standardized tone, ignoring students' heterogeneous emotional states. According to the classic Aptitude-Treatment Interaction (ATI) theory (Cronbach, 1957), allocating everyone to the treatment with the highest average performance is rarely optimal. Therefore, this study integrates the ATI framework to develop a personalized generative AI dialogue system with an "implicit adaptive matching" mechanism. This pilot study aims to examine the learning outcomes of the two experimental conditions and evaluate the preliminary usability of this adaptive mechanism on adult learners before scaling the intervention to a larger adolescent population.

2. Theoretical Foundations for System Development

2.1. SCM Theory and AI Persona Design

This study utilizes the Stereotype Content Model (SCM) to design the AI's persona. Fiske et al. (2002) posited that humans evaluate social entities based on two fundamental dimensions: "Warmth" (assessing intentions, e.g., friendly, sincere) and "Competence" (assessing capability, e.g., efficient, professional). Based on the split-persona effect (Baylor & Kim, 2005), this study abandoned the "all-around" AI design to reduce cognitive load, utilizing prompt engineering to develop two extreme AI personas: a "Warmth-Oriented Bot" (High Warmth/Mid Competence, focusing on empathy and emotional companionship) and a "Competence-Oriented Bot" (High Competence/Mid Warmth, focusing on logical analysis and problem-solving).

2.2. Implicit Adaptive Matching Mechanism

Based on ATI theory, the system uses Phase 0 Implicit Adaptive Matching to diagnose whether students need emotional support or practical strategies, routing them to suitable AI personas. To prevent LLM hallucinations and blind agreement, the design applies Lundy's (2007) model to build a safe digital space. Following Lee et al. (2025) and Zhang et al. (2025), prompt engineering translates NVC into AI logic. Guided by Shao (2023) and Wolfe et al. (2025), negative prompting forbids the AI from sharing fake experiences or generating scripts, ensuring it only scaffolds personal reflection. Phase 0 employs a standardized choice between seeking emotional understanding for warmth or quick solutions for competence. The framework treats user needs as dynamic states instead of fixed traits, utilizing temporary routing without permanent restrictions. Brief sessions of 15 minutes mitigate mismatch risks and encourage exploring diverse coping methods. In forthcoming studies, students will independently select preferred pathways for different conflicts across weeks, enabling the observation of varying AI preferences and minimizing prolonged misclassification risks.

3. Research Method

3.1. Research Design and Participants

To establish practical feasibility and system stability before scaling to junior high schools, this pilot study recruited 16 graduate students (ages 22-27) to compare the instructional effectiveness of a "Baseline NVC AI" (control group, n = 5) and an "Adaptive AI-Supported Instruction" (experimental group, n = 11) in a simulated setting. The experimental group received implicit shunting based on diagnosis, allowing us to examine the learning outcomes of the two experimental conditions. The forthcoming Main Study will involve 6 junior high school classes.

3.2. **Assessment Tools and Statistical Strategy**

Due to the small sample size ($N = 16$), non-parametric statistical methods (Mann-Whitney U and Wilcoxon signed-rank tests) were rigorously applied to prevent Type I errors. Assessment tools included: (1) NVCBS measuring self-connection and authentic expression (Cheung et al., 2023); (2) Situational Judgment Test (SJT) using authentic micro-conflict narratives to assess contextual transfer of NVC skills (Brown et al., 1989); (3) System Usability Scale (SUS) evaluating operational cognitive load (Brooke, 1996); and (4) SCM Perception Scale serving as a manipulation check (Fiske et al., 2002). For mixed-methods log analysis, this study pioneered micro-genetic analysis of AI chat logs. To assess NVC quality during step-by-step scaffolding without penalizing trial-and-error, an "Independent Judgment and Dynamic Piecing" coding principle extracted the student's highest communication quality (capacity ceiling) to form a 0-8 final score. Furthermore, adapted from the BIAS Map (Cuddy et al., 2007) and Wang (2022), logs were systematically quantified into behavioral variables: dialogue survival rate, turn-taking, active/passive facilitation, and passive harm.

Ensuring methodological transparency, 15% of logs were blind-coded by a second rater (Cohen's k = .80), with divergences resolved through consensus.

4. Pilot Study Results and Analysis

4.1. Quantitative Effectiveness: Usability and Learning Outcomes

First, the Mann-Whitney U test showed no significant difference in pre-test NVCBS scores between the two groups (U = 22.00, p = .583), establishing baseline equivalence. Regarding system usability, the experimental group reported significantly higher SUS scores than the theoretical average of 68 (M = 75.68, p = .026), indicating high practical feasibility and intuitive interface design; in contrast, the control group using the baseline AI did not reach significance (M = 65.00, p = .893). Regarding NVC skills, Wilcoxon signed-rank tests for within-group progress showed that the control group achieved a significant improvement (*Mdn* increased from 19.00 to 20.00; Z = -2.06, p = .039). The experimental group also demonstrated a positive growth trend (*Mdn* increased from 20.00 to 22.00; Z = -1.61, p = .107), though it did not reach statistical significance due to the limited power of the extremely small sample size. Furthermore, in the SJT testing real-world conflict application, the experimental group slightly outperformed the control group (M = 8.73, *Mdn* = 10.00 vs. M = 7.00, *Mdn* = 9.00; U = 16.00, p = .221).

4.2. Manipulation Check and Qualitative Insights

Within the experimental group, a Mann Whitney U test showed users assigned to the Warmth oriented AI perceived higher warmth (M = 15.60, *Mdn* = 15.00) than those using the Competence oriented AI (M = 13.17, *Mdn* = 12.50). Although lacking statistical significance (U = 7.00, p = .177) and showing low internal consistency (Cronbach's α = .555) due to a small sample size (n = 11), this trend aligns perfectly with SCM theoretical expectations. Qualitative logs indicated participants averaged 11 dialogue turns. Control group users frequently exhibited passive harm behaviors driven by cognitive fatigue (Wang, 2022); for example, participant C80502 complained about annoyance and aborted the exercise. Conversely, experimental participants demonstrated active facilitation. The Warmth AI successfully comforted D80608 during high stress, enabling them to translate complaints into NVC requests. Furthermore, Dynamic Piecing analysis revealed adaptive AI users frequently achieved high NVC scores by integrating the four components under step by step guidance. This qualitative evidence strongly supports the significantly higher SUS scores reported by the experimental group.

5. Discussion and Conclusion

5.1. Discussion

This pilot study validates the feasibility of using an SCM-based implicit adaptive AI to teach NVC. Although the baseline AI effectively facilitated basic NVC skill acquisition, qualitative logs reveal that its single-standard approach can trigger cognitive fatigue and annoyance. By matching AI persona traits (Warmth vs. Competence) to users' latent emotional needs, the adaptive system significantly enhanced perceived usability and demonstrated better potential in situational transfer (SJT) despite a small sample size. Furthermore, the low internal consistency of the SCM manipulation check highlights a potential spillover effect where AI competence breeds perceived warmth (Wang, 2022).

5.2. Conclusion

Cultivating communication literacy by settling internal anxiety individually will effectively reduce friction in future group interactions, laying a solid socio-emotional foundation for Collaborative Learning. These robust preliminary

findings justify scaling this intervention to the main study involving a larger adolescent population. Future iterations will incorporate delayed post-tests to evaluate long-term behavioral changes, report effect sizes with confidence intervals, and recalibrate the SCM measurement items to clearly distinguish AI personas.

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