"What Can I Control?": Designing an Attribution Reframing Chatbot for Early-Career Employees' Workplace Stress Management

Jung Lee
Department of Intelligence and Information
Seoul National University
Seoul, Republic of Korea
leejungp2@snu.ac.kr

Jaehoon Choi
Interdisciplinary Program in Artificial Intelligence
Seoul National University
Seoul, Republic of Korea
hoon95@snu.ac.kr

Hyungwoo Song
Department of Intelligence and Information
Seoul National University
Seoul, Republic of Korea
rotto95@snu.ac.kr

Minjeong Shin
Department of Intelligence and Information
Seoul National University
Seoul, Republic of Korea
shinmj1024@snu.ac.kr

Bongwon Suh
Department of Intelligence and Information
Seoul National University
Seoul, Republic of Korea
bongwon@snu.ac.kr

Abstract

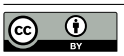
Early-career employees are particularly vulnerable to workplace stress due to psychosocial stressors such as high work demands and low job control. Despite the importance of addressing these stressors, existing digital interventions for early-career employees focus on information-oriented support like onboarding. This study presents an attribution reframing chatbot (AR chatbot) for workplace stress management among early-career employees. Attribution reframing offers a cognitive intervention point of psychosocial stressors by shifting how individuals interpret stress causes along locus and controllability dimensions. Following formative interviews with 11 early-career employees exploring stress situations and interpretation patterns, we evaluated the AR chatbot with 14 early-career employees across two common stress situations. In work-related situation, stress and controllability significantly improved alongside confidence and readiness, whereas in interpersonal situation, only confidence showed improvement. This study contributes to a deeper understanding of workplace stress among early-career employees and offers design implications for supporting early-career employees with the AR chatbot.

CCS Concepts

• **Human-centered computing → Empirical studies in HCI**.

Keywords

Early-career employee, Workplace stress, Attribution reframing, Chatbots, Large Language Models



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1 Introduction

Mental health issues such as depression and anxiety among employees impose substantial social and economic costs worldwide [43]. Early-career employees—those in their first few years of employment—are especially susceptible to workplace stress as they are more likely to have psychosocial stressors because of greater demands and reduced control [22, 26, 37].

Unlike everyday stressors that individuals can often avoid, workplace stress arises from structural constraints, power dynamics, and role expectations that are difficult to change directly [6, 21]. This has led occupational stress research to emphasize interventions targeting employees' psychosocial stressors, like cognitive appraisal and coping responses [34, 39]. Recent advances in large language models (LLMs) have opened new opportunities for scalable support in organizational settings [8, 9, 44]. However, LLM interventions for early-career employees have predominantly prioritized information delivery and uncertainty reduction [10, 14], while psychosocial support remains largely overlooked.

This study presents an adaptive multi-agent LLM chatbot based on attribution reframing (AR chatbot) for early-career employees' workplace stress management. Given the structural nature of workplace stress that is difficult to change for early-career employees, attribution theory—which focuses on how individuals interpret events—provides an effective intervention point for psychosocial problems [28]. Attribution theory is a social psychology theory that explains how individuals interpret the causes of events, with key dimensions including locus and controllability [41]. Attribution Retraining (AR), a therapeutic intervention derived from this theory,

helps modify maladaptive causal explanations by guiding individuals to reinterpret negative events in terms of more adaptive cause (e.g., emphasizing controllability, changing locus from internal to external, etc.) [12].

Meanwhile, recent work on LLM-based cognitive restructuring demonstrates that LLMs can deliver structured reframing interventions at scale with meaningful outcomes [36]. Since AR involves identifying an individual's attribution patterns, guiding reinterpretation through dialogue, and reinforcing adaptive explanations over repeated sessions [17, 19], this process aligns well with core LLM capabilities: scalable conversational interaction, context-sensitive response generation, and sustained availability for iterative practice [15, 20].

In this study, we operationalized AR as Attribution Reframing—a targeted rewriting of one's causal narrative that shifts explanations along attribution dimensions [11]. Previous research has demonstrated that applying AR techniques to diverse populations including workers, college students, and individuals with mental illness can improve emotional and behavioral outcomes such as productivity enhancement and helplessness reduction [11, 16, 29, 33, 40]. Despite the potential of AR to effectively address workplace stressors [16, 33, 40], research applying this technique to LLM-based chatbots for early-career employees remains extremely limited.

We conducted a formative study with 11 early-career employees to identify concrete stress situations and attributions, and derived three design goals for an AR chatbot. Based on these findings, we developed an AR chatbot and evaluated with 14 early-career employees across two situations—work-related and interpersonal—identified as the primary stress categories in our formative study. We conducted a within-subjects evaluation measuring stress, attribution (locus and controllability), and motivation for change (importance, confidence, and readiness) on Likert scales before and after chatbot use, followed by semi-structured interviews. Results showed that the AR chatbot significantly reduced stress and increased controllability, confidence, and readiness in work-related situations, while interpersonal situations showed significant effects in confidence.

This study makes three contributions: (1) an in-depth exploration of how early-career employees experience and interpret workplace stress, (2) design principles for implementing attribution reframing LLM chatbots, and (3) empirical evidence demonstrating differential effect across stress situations, highlighting controllability as a key factor influencing intervention outcomes.

2 Formative Study

Although early-career stressors are explored with systematic review [26, 37], how these employees experience and interpret workplace stress remains underexplored. We conducted a formative study to examine key workplace stress situations, and set design goals for the AR chatbot. Semi-structured interviews were conducted with 11 early-career employees (6 female, 5 male; age M±SD = 26.72±1.96) with 3 months to 3 years of work experience, consistent with a common Korean convention for defining early-career employees [23]. Participants were screened for having experienced stress in workplace within the past 6 months and reporting a stress level of 5 or higher (M±SD = 5.86±1.06) on a 7-point Likert scale. Each interview was conducted via Zoom for 30-45 minutes, audio-recorded and transcribed with participant consent. Data were analyzed using thematic analysis [4] and organized through affinity diagram. This study received IRB approval.

Thematic analysis revealed that early-career employees' stress was categorized into work-related (e.g., top-down procedures and inefficiency) and interpersonal factors (e.g., supervisor communication). Notably, the uncontrollable situation with low organizational status of early-career employees was a common factor underlying both stress situations. However, attribution and coping diverged even in similar situations. Some framed the cause as internal-controllable saying *"I should perform better"*, while others saw it as external-uncontrollable noting *"the company itself is an uncontrollable place."* Some attributions shifted with accumulated experience. Coping strategies also differed according to attribution patterns. Participants with internal-controllable attributions adopted self-improvement strategies, while those with external-uncontrollable attributions chose either indirect coping strategy, or sought social support. Overall, this suggests that attribution-focused intervention could be effective for early-career employees facing structurally hard-to-control stressors.

Based on the interview findings, we propose three design goals: **DG1: Contextualized Problem Analysis** helping users in concretizing their problems through structured questions; **DG2: Dynamic Attribution Tracking** reassessing users' attributions at each turn and adjusting intervention strategies; **DG3: Attribution-Based Adaptive Intervention** changing intervention by attribution dimension as well as each user's situational and relational context.

3 Method

3.1 System Design

Based on the formative study, we developed the AR chatbot with a multi-agent architecture (Figure 1). Five nodes are called sequentially within a LangGraph-based workflow.

The *Problem Analysis Node* addresses DG1 by progressively exploring situations, emotions, and attributions through structured questions. This helps users concretize their problems into contextualized events, mapping to causal search stage in AR [11, 18]. The *Therapy Mapping Node* realizes DG2 and DG3 by estimating locus and controllability scores (0.00–1.00) and selecting an appropriate attribution reframing strategy using few-shot prompting based on prior literature and datasets [2, 11]. The *Therapeutic Response Node* further implements DG3 by providing responses across three stages of attribution reframing: (1) induction, which elicits users' existing causal interpretations and introduces adaptive attributional framing; (2) reconstructing attributions, which guides users to reconsider maladaptive explanations and shift toward more adaptive, controllable interpretations; and (3) consolidation with action planning, which helps users internalize the reframed interpretation and connect it to feasible next steps[11, 18]. In addition, tone adjustment is incorporated into the response when emotion regulation is needed (e.g., strong anger or self-blame). The *Feedback Node* complements DG2 by evaluating conversation progress every five turns to determine whether to deepen the treatment stage or transition to

concrete action planning. The *Risk Detection Node* monitors for self-harm risk at every turn. All nodes used GPT-5.1, with the reasoning model applied to nodes requiring meta-level analysis (Figure 1).

To address privacy concerns, participants used anonymized experiment codes, conversation logs were stripped of identifiable information, and all data were accessible only to the research team and deleted upon completion of the analysis.

3.2 Study Design

Participants. We conducted a within-subjects evaluation with 14 early-career employees (9 female, 5 male; age M±SD = 27.07±2.71) with 3 months to 3 years of work experience. Participants were screened using the same criteria as the formative study. Detailed participant profiles are provided in the Appendix. This study received IRB approval.

Measures. All measures were administered separately for work-related situations and interpersonal situations. Stress was measured with a single item on a 7-point Likert point scale, and higher scores indicated greater stress level. For attribution, locus and controllability were each measured with a single item on a 7-point Likert scale ranging from 1 (external/uncontrollable) to 7 (internal/controllable), based on the Attributional Style Questionnaire (ASQ) [32]. Motivation for behavior change was measured using the ICR scale, comprising importance, confidence, and readiness on a 10-point Likert scale with higher scores indicating greater motivation [30]. Chatbot usability was evaluated using the SUS scale [5], administered once after all conversations were completed. The questionnaires used in the study are detailed in the Appendix.

Procedure. Participants first completed pre-questionnaires (stress, attribution, and ICR scales) for both their most stressful work-related and interpersonal experiences within the past six months. They then completed a 5-minute tutorial conversing with the chatbot. In the main study, participants engaged in two conversations—one for each stress situation they had reported in the pre-questionnaires (work-related and interpersonal). Each conversation lasted a minimum of 10 turns (M±SD = 13.29±2.60) to ensure exposure to all chatbot nodes. After completing the main study, participants responded to post-questionnaires (stress, attribution, ICR, and SUS scales). Finally, a 30-minute semi-structured interview was conducted with the researcher. The entire session lasted approximately 70 minutes.

Analysis. To compare pre-post changes for each measure, we used the Wilcoxon signed-rank test with a significance level of 0.05. Post-study interviews were audio-recorded, transcribed, and analyzed using thematic analysis.

4 Results

4.1 Quantitative Analysis

4.1.1 Effect on Stress Levels. Analysis of pre-post stress levels revealed a significant decrease in work-related situations (p = .018, r = .64). Interpersonal situations also showed reduction (p = .094, r = .45), though the effect was marginally significant. These results provide an initial signal that the AR chatbot may help reduce overall workplace stress, with particularly strong effects in work-related situations.

Table 1: Pre-Post Comparison by Situation (N = 14)

Situation	Variable	Pre	Post	p	r
Work-related	*Stress*				
	Stress	5.43 (0.76)	4.14 (1.51)	.018*	.64
	Attribution				
	Locus	3.00 (1.62)	2.79 (1.58)	.380	.24
	Controllability	2.71 (1.38)	3.79 (1.37)	.014*	.66
	Behavior Change				
	Importance	7.50 (2.28)	8.00 (1.57)	.931	.02
	Confidence	5.00 (2.15)	7.07 (1.90)	.002**	.82
	Readiness	4.86 (1.88)	6.57 (2.17)	.014*	.66
Interpersonal	*Stress*				
	Stress	5.57 (1.09)	4.43 (1.74)	.094†	.45
	Attribution				
	Locus	2.79 (1.63)	2.86 (1.88)	.885	.04
	Controllability	2.86 (1.10)	3.21 (1.72)	.478	.19
	Behavior Change				
	Importance	7.64 (1.65)	8.00 (1.66)	.432	.21
	Confidence	4.71 (2.37)	6.64 (2.41)	.004**	.76
	Readiness	5.14 (2.25)	6.50 (2.44)	.135	.40

Note. Wilcoxon signed-rank test. $r = Z/\sqrt{N}$.
Attribution: locus, 1 = external to 7 = internal; controllability, 1 = uncontrollable to 7 = controllable.
†$p < .10$. *$p < .05$. **$p < .01$.

4.1.2 Effect on Attributions. Attribution changes were analyzed in terms of locus and controllability. Overall, participants showed a tendency toward external (pre M = 3.00, post M = 2.79) and uncontrollable (pre M = 2.71, post M = 3.21) attribution in both pre and post measurements. Locus showed no significant change in either situation (work-related: p = .380, r = .24; interpersonal: p = .885, r = .04). However, controllability increased significantly in work-related situations (p = .014, r = .66), suggesting that participants perceived work-related situations as more controllable after conversing with the AR chatbot. In interpersonal situations, controllability increased but not significantly (p = .478, r = .19). This pattern points to a possible differential effect, where work-related attributions are more amenable to reframing than interpersonal ones.

4.1.3 Effect on Motivation for Behavior Change. Changes in motivation for behavior change were analyzed using the ICR scale. Importance showed no significant change in either situation (work-related: p = .931, r = .02; interpersonal: p = .432, r = .21). Confidence significantly increased in both situations, with large effect sizes (work-related: p = .002, r = .82; interpersonal: p = .004, r = .76). Readiness significantly increased in work-related situations (z = -2.47, p = .014, r = .66) but not in interpersonal situations (p = .135, r = .40). These results suggest that participants showed improvements in confidence for coping with stress situations through conversations with the AR chatbot, while readiness gains were observed primarily in work-related situations.

4.1.4 System Usability. The chatbot received excellent usability ratings in SUS scale (M±SD = 81.07 ± 8.13), which corresponds to an "Excellent" rating. Participants reported ease of use and natural conversation flow.

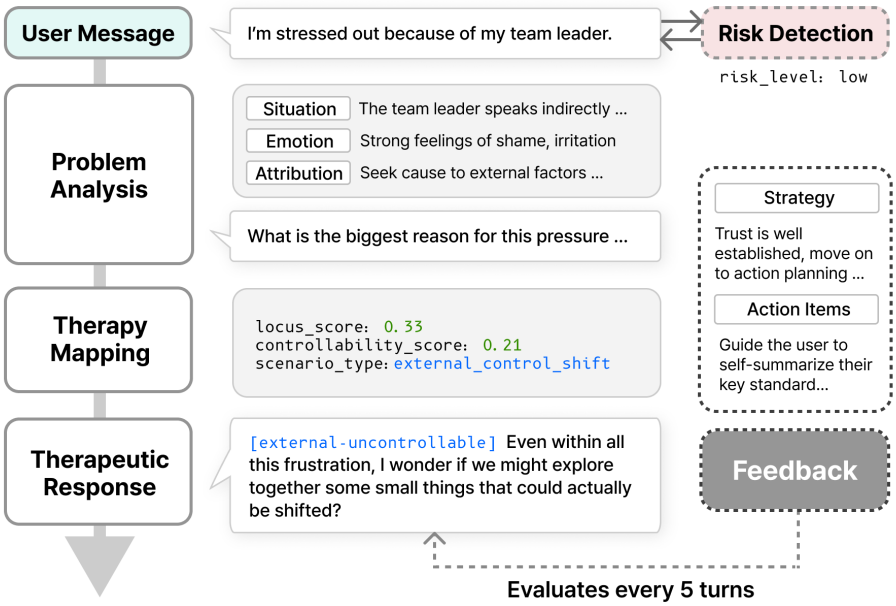

Figure 1: AR chatbot system in the *external-uncontrollable* attribution scenario. Every message passes through a *Risk Detection Node*, after which it is processed sequentially—*Problem Analysis* → *Therapy Mapping* → *Therapeutic Response*—according to the conversational flow. A *Feedback Node* adjusts the therapeutic direction once every five turns.

4.2 Qualitative Analysis

4.2.1 Controllability and Its Differential Effects Across Stress Situations. The results indicate that the chatbot's effectiveness varied depending on the characteristics of the stress situation. Post-interviews revealed that participants in work-related situations found the chatbot helpful in identifying controllable aspects of their situation and developing concrete action plans. P14 responded, *"The chatbot's questions about my baseline standards made me think I should establish clear criteria."* In contrast, interpersonal situations elicited more skeptical responses regarding controllability itself. P12 noted, *"The empathetic dialogue didn't resonate because I felt there was nothing else I could have done."*

Interestingly, some participants reported the opposite experience. P2 said *"Work-related issues are hard to get advice on unless it involves coworkers, but interpersonal issues allow me to try suggestions,"* indicating that interpersonal situations were more helpful for them. Additionally, when direct problem-solving is difficult, approaches that explore alternative coping strategies beyond attribution reframing may be more effective. P13 suggested, *"If there's nothing changeable, it would be better to ask about ways to refresh myself."* These findings suggest that not only the type of situation, but users' perception of controllability may serve as a critical factor in considering intervention strategies.

4.2.2 Attribution Reframing on Perspective Shift. Structured dialogue through the AR chatbot facilitated cognitive reframing of participants' stress situations. Systematically segmenting the situation along attribution dimension helped participants organize their thoughts and develop a more objective viewpoint. P3 described it as *"viewing the situation from a third-person perspective."*

Compared to standard GPT, the AR chatbot provided a more structured counseling experience. P13 evaluated it by saying, *"Unlike regular GPT used as an emotional trash bin, this conversation systematically asked whether I had considered certain aspects, making it feel closer to a real counselor."* However, the question-driven dialogue flow increased cognitive load for some participants. P1 noted, *"The follow-up questions were sometimes tiring. I wish the chatbot would occasionally suggest direct solutions for resolving my concerns."* These findings suggest that while structured questions can facilitate deeper problem understanding, the chatbot should dynamically balance such questions with direct suggestions according to users' situational context and readiness.

Beyond perspective shift, interviews included cues consistent with increased confidence and readiness in work-related situations. Participants described feeling more able to try coping strategies. P4 stated, *"There were some solutions I wasn't brave enough to try, but I felt I should seriously think about them and actually put them into action."*

5 Discussion

Our findings offer three key contributions to the design of the AR mental health chatbot for early-career employees.

First, this study identifies **controllability as a key moderator** of attribution reframing effectiveness. While work-related situations showed significant improvements across stress, controllability, confidence, and readiness, interpersonal situations improved only

in confidence. Qualitative data further suggest that this pattern reflects participants' differential perceptions of controllability—those who discovered controllable aspects reported more positive experiences regardless of situation type. This finding extends prior research linking low job control to depression risk among young workers [24, 26, 37]. Meanwhile, the absence of significant change in locus is consistent with prior evidence suggesting that locus is relatively stable and unlikely to shift through short-term experiences [7]. Controllability thus appears to be a more actionable intervention target in conversational settings.

Moreover, intervention effectiveness can vary not only by controllability but also by individual characteristics. In the formative study, participants diverged in how they initially interpreted similar stressors and adopted correspondingly different coping strategies. The user study similarly revealed that participants responded differently to the chatbot even within the same situation type. Prior research addressing individual factors such as attributional style [27, 42], self-efficacy [31], and organizational tenure [35] helps explain why participants responded differently to the chatbot. Additional research is needed to examine how such individual differences moderate AR chatbot effectiveness, thereby informing more personalized intervention pathways.

Second, our findings suggest that structured attribution exploration itself may carry therapeutic value beyond reframing outcomes. Participants reported that systematically decomposing stressful situations along attributional dimensions helped them gain cognitive distance and view problems from *"a third-person perspective."* Some participants also described the chatbot prompted them to consider aspects of the situation they had not fully considered before. This effect aligns with prior LLM-based systems showing that structured reflection scaffolds thought organization and supports actionable insight generation [1, 25, 38]. These findings point to the need for future studies comparing the AR chatbot with control conditions and other conversational intervention approaches.

Third, our results suggest design implications for adaptive intervention pathways. In our system, adaptivity was implemented by dynamically assessing users' situations, emotions, and attributions, then adjusting AR strategy, response tone, and the timing of action planning. This worked better in work-related situations, where participants more readily identified controllable aspects and translated reflection into concrete next steps. However, when perceived controllability is low, AR alone may not be sufficient. Future LLM chatbots should incorporate multi-pathway designs that respond to low perceived control by shifting from situation change to resource building [3] or organizational social support [13, 35].

6 Limitations and Future Work

This study used a relatively small sample for empirical experiment (N = 14) and the intervention lasted only a single day. Future research with extended intervention periods and control group comparisons could provide more robust evidence of intervention effectiveness for early-career employees.

Given the crucial role of controllability, future research could examine chatbot effectiveness in occupations with structurally low control—such as customer service representatives, call center workers, and nurses—where identifying controllable aspects within constrained environments could provide meaningful psychological benefit. In addition, comparative studies with other interventions would help clarify the specific advantages of the AR chatbot.

Finally, real-world deployment of an AR chatbot in organizational settings would require careful attention to privacy concerns. Early-career employees may hesitate to disclose workplace stress if conversation data could be accessed by HR departments or supervisors. Future implementations should address this through measures such as end-to-end encryption and transparent data governance policies.

7 Conclusion

This study examined workplace stress among early-career employees and elicited the design of the AR chatbot for psychosocial support. In a within-subject evaluation across work-related and interpersonal stress situations, the chatbot reduced stress and improved controllability as well as confidence and readiness in work-related situations, whereas in interpersonal situations it primarily increased confidence. These findings suggest that attribution reframing is most beneficial when stressful episodes include actionable, controllable elements, and they provide practical design implications for building context-sensitive LLM chatbots that help early-career employees reframe causal interpretations and move toward coping actions.

Acknowledgments

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