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Development of a Generative AI-Supported Reflection System for Sustaining Learners' Motivation

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Abstract: In the era of rapid reskilling, adult self-directed learners often struggle with volitional persistence in isolated digital environments. This research addresses these challenges through the design of an AI-driven "Learning Reflection System" grounded in Instructional Design (ID) principles. Developed using Gemini Flash-2.5 and Streamlit, the system integrates Goal-Setting and Reflection Chatbots supported by iterative templates. An expert review validated the system's theoretical integrity and educational utility, confirming high alignment with the ARCS-V model for domain-independent guidance. This study establishes a foundation for integrating Generative AI with ID theories, offering a scalable approach to personalized coaching that facilitates persistence.

Keywords: Instructional Design, ARCS-V Model, Adult Learning, Generative AI, Volition, Reflection, Chatbot

1. Introduction and Research Context

In the current era of unpredictable shifts and systemic intricacy—often referred to as the VUCA era—continuous learning and adaptation are no longer optional for professionals. Corporate trends reflect this shift; according to Teikoku Databank (2024), companies in information services and finance are proactively supporting employee reskilling to remain competitive. However, adult learning is highly individualized, which often leads to a sense of isolation and significant motivational challenges.

With the rise of digital e-learning platforms, the need for effective support systems to foster motivation and persistence has become increasingly critical. Empirical data highlights the severity of these challenges: a recent survey found that approximately 70% of adult learners have experienced "dropping out," with the primary factor cited as the "difficulty of maintaining motivation". Furthermore, motivation declines significantly when learners cannot find a clear relevance between the learning content and their professional tasks.

While Generative Artificial Intelligence (GenAI) has opened new possibilities for support through interactive dialogue, there remains a paucity of practical implementations utilizing GenAI to visualize and support motivational states specifically based on established ID models. This research develops a support system for adult self-directed learners by synthesizing reflective journaling with interactive AI assistance to bolster volitional persistence.

1.1 Theoretical Framework: The ARCS-V Model

To provide robust motivational support, the system utilizes Keller's (2010) ARCS-V model. The model's components are defined as follows in Table 1 to guide the system's design claims:

Table 1. *The ARCS-V Model*

ARCS-V model	**Definition**
Attention (A)	Stimulating and sustaining the learner's curiosity and interest.
Relevance (R)	Connecting learning goals to the learner's specific professional tasks and prior experience.
Confidence (C)	Supporting self-efficacy and the expectation of success through scaffolding.
Satisfaction (S)	Reinforcing the learning experience through the practical application of knowledge.
Volition (V)	The continuous "will" and effort required to protect and achieve goals despite distractions.

2. Research Design and Methodology

This study employs a Design and Development Research (DDR) approach, structured into four distinct phases: (1) Design, (2) Expert Review, (3) Implementation, and (4) Formative Evaluation. This paper focuses specifically on Phases 1 and 2. While the overall research aim is to measure the system's impact on learner persistence, this manuscript reports on the theoretical validation and prototype refinement resulting from the initial design and expert review phases.

3. System Implementation

The "Learning Reflection System" is a theory-driven web application designed to support a cyclical pedagogical workflow through the utilization of two AI chatbot applications as shown in Figure 1.

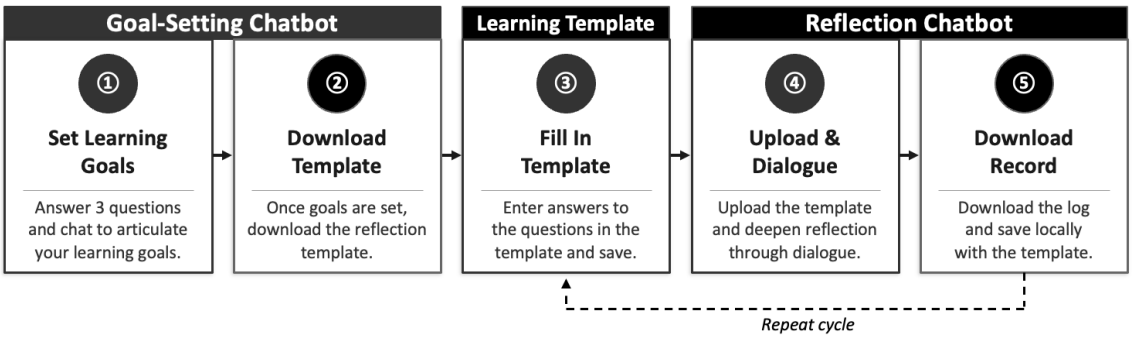

Figure 1. Learning System Flow.

The system is built using the Streamlit framework for Python. The Google Gemini API (Flash-2.5) powers the natural language processing, while Supabase serves as the backend for user authentication and persistent storage of interaction histories. Interaction logs can be exported in Word or CSV formats for qualitative analysis.

3.1 Goal-Setting Chatbot

The Goal-Setting Chatbot employs an Instructional Designer persona to guide adult learners in formulating specific, measurable objectives. The implementation logic follows two core frameworks: SMART goals and the "three elements of goal clarification" (Suzuki, 2015, p. 115) (behavioral objective, deadline, and evaluation criteria) as explained in Table 2.

Table 2. *Goal Clarifications*

Element	**Function**
Scaffolding	The application first requires inputs for these three elements.
Dialogue Management	The AI then engages in a probing dialogue—limited to one question at a time to minimize cognitive load—to refine these inputs.
Objective Generation	Finally, the system performs an internal "self-review" to generate three logically sound candidate objectives. Upon user selection, a structured Reflection Template DOCX) is generated.

3.2 Learning Journal and Reflection Chatbot

The reflection process centers on a standardized template that structures reflection using the YWT (Yatta/Done, Wakatta/Discovered, Tsugi/Next) framework (Japan Management Association) as shown in Table 3. This component facilitates deep metacognition by analyzing user-uploaded journals through the lens of the ARCS-V model.

Table 3. *Reflection Prompts and Corresponding Instructional Strategies*

Prompt	**Phase (YWT)**	**ID Strategy (ARCS-V)**
"What learning or activities did you perform today?"	**Y** (What was done)	Factual progress summary
"What specific points left an impression on you?"	**W** (Discovered)	**Attention**: Stimulate interest
"How did new facts differ from your prior knowledge?"	**W** (Discovered)	Metacognitive gap analysis
"What are your plans for the next session?"	**T** (Next steps)	**Volition**: Future commitment

Upon uploading the journal, the chatbot initiates a three-stage interaction: Validation (acknowledging effort), Confidence Calibration (reinforcing self-efficacy), and Volitional Reinforcement (final will-check), as partially demonstrated in Figure 2.

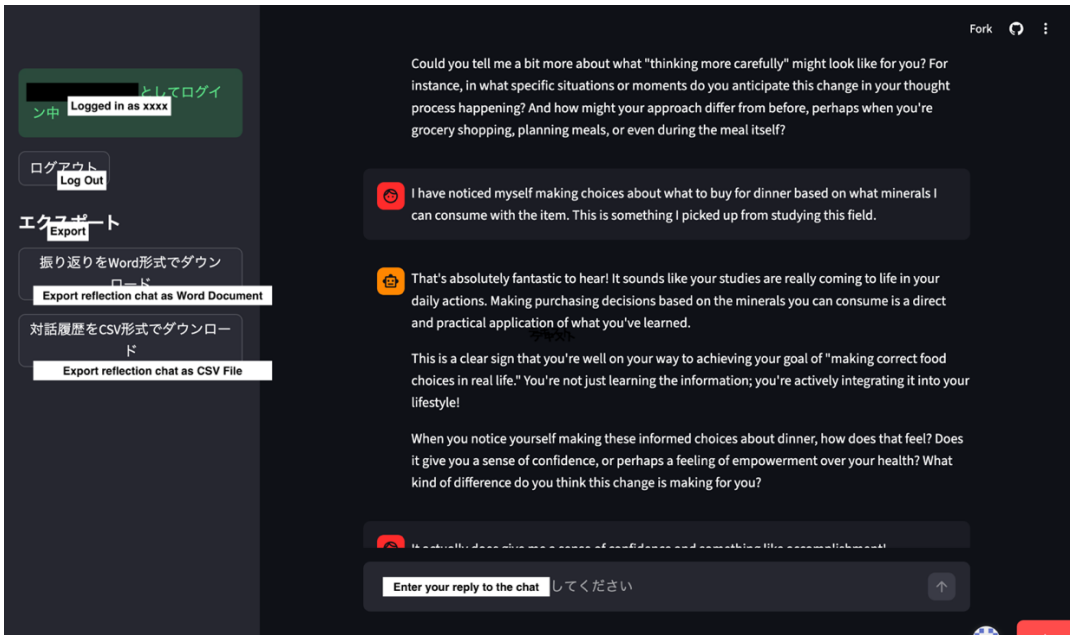

Figure 2. Interactive dialogue within the Reflection Chatbot.

4. Expert Review

The prototype underwent a three-week evaluation by two specialists: Expert 1 (E1), a UX/UI professional in game development, and Expert 2 (E2), an Instructional Design scholar.

Table 4. *Expert Review Scores and Primary Qualitative Findings*

Component	Scores (E1, E2)	Key Points	Points to Redesign
Overall Approach	4, 4	Sound SRL framework; effective goal-to-reflection workflow.	Strengthen API rate-limit handling
Goal-Setting Bot	2, 3	Effective ID persona	Requires "Learner Analysis" for entry.
Reflection Bot	2, 4	High psychological safety	Requires "Interaction Load" control.
System Integration	3, 4	Logical data flow	Requires iterative "Goal-Revision" loops.

4.1 Critical Improvements for Professional Reskilling

The experts identified that a lack of an initial "Entry Behavior" assessment in the Goal-Setting phase could lead to unrealistic objectives if prior knowledge is not accounted for. In the context of professional reskilling (e.g., IT/Finance), this module will be refined to analyze the learner's specific industry context. Furthermore, to prevent "interaction fatigue," the system will implement flexible engagement modes, such as "Light" vs. "Deep" reflection settings, to mitigate user dropout. Finally, a closed-loop design will be implemented to allow reflection data to flow back into the Goal-Setting phase for iterative objective adjustment.

5. Conclusion and Future Work

This study's significance lies in synthesizing reflective journaling with AI-driven coaching to bolster learner persistence. By utilizing the ARCS-V model, the system mitigates surface-level reflection and reconciles learner progress with established goals. Future work will focus on integrating the Learner Analysis module and conducting empirical trials with adult learners to measure the system's impact on volitional persistence through longitudinal interaction logs and surveys.

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