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AI-Enhanced Research Coaching for Graduate Education: A Mixed-Methods Evaluation of Learning Outcomes and Educational Design Effectiveness

Unyaparn Sinlapaninman, Wannatida Yonwilad

Research Article

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Author for correspondence:
Wannatida Yonwilad
wantida.yo@ksu.ac.th
Kalasin University, Thailand

Abstract

Background/purpose. This study addresses challenges in graduate research supervision by developing and evaluating an AI chatbot research coaching system designed through Design Thinking and Educational Design Research. The research aimed to examine system usability, perceived value, and alignment between user experiences and original design principles.

Materials/methods. Thirty graduate students from Learning Management Innovation programs at a Thai university participated in a mixed-methods evaluation. The system, grounded in the GROW coaching model and delivered via LINE and Dialogflow, provided structured guidance, templates, and automated feedback. Data collection included Likert-scale questionnaires, open-ended reflections, and focus group discussions, which the researchers analyzed using a convergent mixed-methods approach.

Results. The system achieved high satisfaction (M = 4.52) and strong emotional engagement across diverse levels of digital literacy. Qualitative analysis revealed six themes, including enhanced understanding of research, increased confidence, and perceived social presence. Participants developed unexpected emotional attachments, describing the system as a "thinking partner." A strong alignment emerged between user feedback and design principles, yielding notable outcomes in conceptual understanding, skill application, and milestone completion.

Conclusion. Results demonstrate that emotionally intelligent AI coaching systems can effectively support graduate research development by addressing both cognitive and affective learning dimensions. The study provides a validated framework for developing culturally sensitive, user-centered educational technologies in resource-constrained contexts.

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1. Introduction

Despite growing emphasis on graduate research productivity globally, many students continue to face substantial challenges in navigating the complex research process. These challenges include limited access to timely supervision, unclear methodological planning, and psychological strain from academic isolation (Lee, 2008; Pyhältö et al., 2009). In Southeast Asian higher education contexts, a major public university study reported that 67% of master's students and 82% of doctoral candidates experienced difficulties in planning their research and obtaining adequate support (Srisa-ard & Sangsiri, 2022). The COVID-19 pandemic has further compounded these issues by disrupting face-to-face mentoring relationships and increasing advisory burdens on faculty members (OECD, 2023). Within this challenging landscape, the need for more accessible, consistent, and personalized research coaching has become increasingly urgent, particularly in resource-limited academic environments.

Recent technological innovations have introduced AI-powered systems and chatbot interfaces to address challenges in research mentoring. Studies demonstrate that conversational systems can facilitate goal-setting, provide immediate feedback, and support learner autonomy (Bailey et al., 2022; Winkler & Söllner, 2018). However, most existing solutions prioritize technical efficiency or general usability metrics rather than examining their educational impact or effectiveness in reducing the emotional burden associated with graduate research. Pérez-Marín (2021) observed that many such tools remain static, offering only predefined FAQs with limited capacity to adapt to diverse academic needs or contexts.

Despite the proliferation of AI-based educational tools, there remains a significant gap in understanding how design-based, emotionally responsive research coaching systems perform in authentic graduate education contexts. Specifically, three critical gaps persist: (1) limited empirical evidence on how AI chatbot systems actually enhance graduate students' research competence and emotional well-being during thesis development (Winkler & Söllner, 2018; Kim et al., 2022), (2) insufficient integration of educational design principles with user experience evaluation in AI-enhanced learning support systems (McKenney & Reeves, 2012; Brown, 2009), and (3) lack of comprehensive assessment frameworks that examine both learning outcomes and alignment between design intentions and user experiences in research coaching interventions (Anderson & Shattuck, 2012).

This study addresses these gaps by evaluating an AI-chatbot research coaching system developed through Design Thinking and Educational Design Research (EDR) approaches (McKenney & Reeves, 2012; Brown, 2009). The system was grounded in the GROW coaching model (Whitmore, 2009) and delivered through accessible platforms, incorporating structured templates, reflective prompts, and automated feedback mechanisms. The development process involved iterative co-design with academic stakeholders from a Thai public university, ensuring alignment with authentic graduate research challenges.

This research contributes to three important areas. Theoretically, it advances understanding of how design-based research principles can inform the development of AI-enhanced educational tools (Plomp, 2007; Van den Akker, 1999). Practically, it provides empirical evidence for the effectiveness of conversational coaching systems in supporting graduate research processes, addressing calls for more contextual educational technology research (UNESCO, 2018; OECD, 2021). Methodologically, it demonstrates how mixed-methods evaluation can assess both user experience and learning outcomes in educational technology research (Creswell & Plano Clark, 2017). These contributions are particularly relevant for institutions seeking to enhance research training quality while addressing resource constraints and emotional challenges faced by graduate students.

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Accordingly, this study investigates: To what extent does an AI-chatbot-based research coaching system enhance user experience, support perceived research competence, and align with original design intentions in authentic educational contexts? This central question is addressed through three specific objectives: (1) examining the usability and user experience of the coaching system, (2) evaluating the perceived value of the system in supporting graduate-level research, and (3) exploring alignment between user feedback and original design principles.

2. Literature Review

2.1. Theoretical Framework: The GROW Model and Cognitive-Behavioral Foundations

The GROW model (Goals, Reality, Options, Wrap-up), developed by Whitmore (2009), provides a structured framework for coaching conversations that aligns well with cognitive-behavioral therapeutic approaches. The model's emphasis on goal-setting and reality assessment draws from cognitive-behavioral theory, which posits that learning occurs through the interaction of cognitive processes, behavioral outcomes, and environmental factors (Pergantis et al., 2025). In educational contexts, the GROW framework has been successfully adapted to support learner autonomy and self-regulation, particularly in complex learning tasks such as research writing (Mohebbi, 2025).

The psychological foundations of the GROW model are rooted in solution-focused brief therapy and cognitive restructuring techniques (Whitmore, 2009). These approaches emphasize helping individuals identify their current situation (Reality), clarify desired outcomes (Goals), explore possible pathways (Options), and commit to action (Wrap-up). This cognitive-behavioral foundation makes the GROW model particularly suitable for addressing the complex emotional and procedural challenges faced by graduate students in research contexts (Pyhältö et al., 2009).

2.2. Graduate Research Supervision Challenges: Beyond Traditional Mentoring

Graduate students consistently report difficulties in research supervision that extend beyond content knowledge to include emotional support, process guidance, and timely feedback (Lee, 2008; Pyhältö et al., 2009). Recent studies in Asian higher education contexts reveal that supervision challenges are compounded by cultural factors, including hierarchical relationships, face-saving behaviors, and limited questioning of authority figures (Wang & Fesenmaier, 2021). These factors create additional barriers to effective research mentoring, particularly when students require iterative feedback and emotional support.

The COVID-19 pandemic has exacerbated existing challenges by disrupting traditional face-to-face supervision models (OECD, 2023). A longitudinal study by Moretti and Simmons (2023) found that graduate students experienced decreased satisfaction with supervision quality during remote learning, particularly due to delays in feedback and reduced motivation. Although traditional mentoring programs remain beneficial, they often lack personalization and scalability, especially in resource-constrained contexts (Gardner, 2009).

2.3. AI-Enhanced Educational Technology: From Static Tools to Adaptive Systems

The evolution of educational technology has progressed from static learning management systems to adaptive, AI-powered platforms capable of personalized interaction (Holmes et al., 2019). Conversational AI systems, including chatbots, have demonstrated effectiveness in supporting learner autonomy, providing immediate feedback, and maintaining engagement across various educational contexts (Winkler & Söllner, 2018).

However, most existing chatbot systems in education remain limited in their ability to address complex emotional and cognitive needs. A systematic review by Pérez-Marín (2021) identified that 73% of educational chatbots rely on rule-based responses with limited adaptability to individual learner contexts. This limitation is particularly problematic in graduate research settings, where

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students require nuanced guidance that considers both academic content and emotional well-being (Bailey et al., 2022).

Recent advances in natural language processing and affective computing have enabled the development of more sophisticated educational chatbots capable of recognizing emotional states and adapting responses accordingly (Banjar et al., 2024). These developments create new opportunities for emotionally responsive research coaching systems.

2.4. Design Thinking and Educational Design Research: Bridging Theory and Practice

Educational Design Research (EDR) provides a methodological framework for developing educational interventions that are both theoretically grounded and practically relevant (McKenney & Reeves, 2012; Plomp, 2007). When combined with Design Thinking approaches, EDR enables the creation of user-centered solutions that address authentic educational challenges through iterative refinement (Brown, 2009).

The integration of Design Thinking with EDR has proven particularly effective in educational technology development, where solutions must balance technical feasibility with pedagogical soundness and user acceptance (Van den Akker, 1999; Anderson & Shattuck, 2012). This approach emphasizes empathy with users, the definition of authentic problems, the ideation of creative solutions, the prototyping of functional interventions, and testing in real-world contexts (Kim et al., 2023).

2.5. User Experience and Perceived Value in Educational Technology

User Experience (UX) in educational technology encompasses both functional usability and emotional engagement (Hassenzahl & Tractinsky, 2006; Norman, 2004). Recent research emphasizes that educational technology success depends not only on technical functionality but also on users' emotional connection to the system and perception of its educational value (Kim et al., 2022).

Perceived value in educational contexts is multidimensional, including cognitive benefits (learning outcomes), affective benefits (emotional support), and behavioral benefits (improved engagement and persistence) (Zeithaml, 1988). Studies of AI-enhanced learning systems indicate that perceived social presence—the sense of interaction with an intelligent agent—significantly influences both user satisfaction and learning outcomes (Lee et al., 2022; Zhou et al., 2023).

2.6. Research Gaps and Study Rationale

Despite advances in AI-enhanced educational technology and coaching methodologies, significant gaps remain in understanding how design-based, emotionally responsive research coaching systems function in authentic graduate education contexts. Current literature lacks comprehensive evaluation frameworks that assess both learning outcomes and alignment between design intentions and user experiences (Venkatesh & Davis, 2000).

Furthermore, while the GROW model has been applied in various coaching contexts, its integration with AI-powered systems for research mentoring remains underexplored, particularly regarding the psychological mechanisms that drive user engagement and perceived value (Salah, 2024). This study addresses these gaps by providing empirical evidence for the effectiveness of a theoretically grounded, design-based AI coaching system in supporting graduate research processes.

3. Methodology

This study is grounded in the broader Design-Based Research (DBR) framework, following the iterative design cycle proposed by McKenney and Reeves (2012), which highlights relevance, practicality, and effectiveness in authentic educational contexts. The research followed the five phases of design thinking—empathize, define, ideate, prototype, and test—to systematically address

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the real-world challenges encountered by graduate students in conducting research. Insights from earlier phases, including focus group interviews, expert consultation, and thematic analysis (Braun & Clarke, 2006), highlighted key pain points in students' research experiences: unclear methodological planning, lack of structured guidance, emotional stress, and limited feedback from advisors.

To address these challenges, the blended research coaching system leverages the LINE Official Account integrated with Dialogflow and is grounded in the GROW coaching model (Whitmore, 2009). The system provided asynchronous, personalized coaching support throughout students' research journeys, emphasizing clarity, emotional support, and process tracking.

3.1. Research Design

This study employed a mixed-methods exploratory design (Creswell & Plano Clark, 2017) situated within the broader Design-Based Research (DBR) framework (McKenney & Reeves, 2012). The research addressed three specific objectives: (1) examining system usability and user experience, (2) evaluating perceived value in supporting graduate research, and (3) assessing alignment between user feedback and original design principles.

The study collected quantitative data using Likert-scale questionnaires to measure user experience dimensions and gathered qualitative data through open-ended reflections and focus group discussions. Data integration followed a convergent parallel approach, analyzing quantitative and qualitative findings separately before comparing them for triangulation and comprehensive interpretation (Fetters et al., 2013). To ensure methodological rigor, researchers systematically aligned each research objective with appropriate data collection and analysis methods. This alignment strengthens the validity of findings and ensures that both quantitative and qualitative approaches effectively address the intended research aims within the design-based research framework.

Table 1. Objective-Method Matching.

Research Objective	Sample	Instrument	Setting
Objective 1: UX Assessment	30 graduate students	Reflective Rating Scale Questionnaire	After system use
Objective 2: Perceived Value	Same as above	Open-ended reflection questions (5 items)	After system use
Objective 3: Design Alignment	Research participants	Reflective Design Alignment Protocol Form	Post-intervention

3.2. Research Setting and Context

This study took place at a public university in Thailand offering graduate programs in learning management innovation. The study selected this institution for its representative characteristics of Thai higher education contexts, including diverse student backgrounds, resource constraints typical of public universities, and established graduate research programs. Over the course of three weeks, all participants utilized the AI coaching system during their regular thesis development activities.

3.3. Participants and Sampling

The participants consisted of 30 graduate students (18 Master's, 12 Doctoral) from the Learning Management Innovation programs. Purposive sampling was employed as a non-probability sampling method to ensure participants met specific inclusion criteria essential for addressing the research

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objectives (Patton, 2015). The sampling method involved selecting participants based on: (1) current enrollment in graduate programs, (2) engagement in thesis research development (Chapters 1-3), (3) prior participation in earlier DBR phases, and (4) commitment to a minimum 3-week system usage.

The researchers selected a subgroup of six participants for in-depth focus group interviews based on diversity in digital skills and research backgrounds.

Sample Size Determination: The study justified the sample size of 30 participants through multiple considerations: (1) qualitative saturation principles—Guest, Bunce, and Johnson (2006) recommend 12–30 participants for achieving thematic saturation in homogeneous populations, (2) mixed-methods guidelines—Creswell and Plano Clark (2017) suggest 20–30 participants for exploratory mixed-methods studies, and (3) DBR methodology—McKenney and Reeves (2012) emphasize depth over breadth in iterative design research contexts.

Digital Literacy Analysis: Although participants' digital literacy levels were heterogeneous, the study conducted specific differentiation and analysis to examine the impact of this variable. Researchers assessed digital literacy using a 5-point self-assessment scale covering basic computer skills, online communication tools, and mobile application usage. The participant distribution showed that 7 participants (23%) reported basic digital literacy, 16 (53%) reported intermediate, and 7 (23%) reported advanced. Analysis approach: Thematic analysis was conducted to examine differences in user experiences across digital literacy groups, with particular attention to how different literacy levels influenced system interaction patterns and perceived value.

3.4. Data Collection Instruments

3.4.1. Reflective Rating Scale Questionnaire

The study developed a custom Likert-scale reflection questionnaire to assess graduate students' experiences while using the research coaching system. The instrument consisted of 20 items across five dimensions, aligned with core principles of Design-Based Research (DBR) (Wongwanich, 2020):

1. Perceived relevance of the system to learners' research problems and context (design relevance).

2. Alignment with learning needs and goals (intervention validity).

3. Self-perceived learning outcomes, including research comprehension, methodological application, and task completion.

4. User experience and emotional engagement (e.g., confidence, stress reduction) align with human-centered and posthumanist design (Bayne, 2015).

5. Suggestions for future improvement (iterative refinement).

Three experts in educational innovation evaluated content validity. The Item-Objective Congruence (IOC) index ranged from 0.67 to 1.00, indicating acceptable to high alignment between items and intended constructs (Turner & Carlson, 2003).

3.4.2. Open-Ended Reflection Questions

To gain qualitative insights into user experiences, an open-ended reflection component included five prompts:

1. What research problems did the system help address?

2. Which system features or content were most relevant to research needs?

3. In what ways did the system enhance the research process?

4. How did participants feel while engaging with the system?

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5. What suggestions did participants provide for improving the research coaching system?

3.4.3. Reflective Design Alignment Protocol (RDAP) Form

This protocol captures alignment between users' lived experiences and the original design principles embedded in the system. The RDAP form facilitates the mapping of emergent themes from user reflections (both quantitative and qualitative) back to the substantive and procedural design (e.g., P–Q–R, K–L–M) proposed during the design phase (Wongwanich, 2020).

3.5. Data Collection Procedures and Validation

Expert Review Process: Five experts in educational technology and instructional design, each with over five years of experience and a publication record, reviewed the system and instruments. They provided structured feedback using a rubric, with agreement thresholds set at 80% for item inclusion and content approval.

Data Collection Timeline

Phase 1 (Week 1): Participant orientation, consent procedures, baseline digital literacy assessment

Phase 2 (Weeks 2-4): Independent system use during regular research activities with weekly check-ins

Phase 3 (Week 5): Post-implementation data collection (questionnaires, reflections, focus groups)

3.6 Data Analysis

This study employed a mixed-methods data analysis strategy aligned with design-based research (DBR). Quantitative data from the Reflective Rating Scale Questionnaire were analyzed using descriptive statistics, including mean scores, standard deviations, and frequency distributions.

Qualitative data derived from five open-ended reflection questions were analyzed using Braun and Clarke's (2006) six-step thematic analysis: 1) data familiarization through multiple readings, (2) initial inductive coding of meaningful segments, (3) theme identification through pattern recognition, (4) theme review for coherence and validity, (5) theme definition and naming, and (6) report writing with illustrative quotations. This systematic approach enabled the identification of recurring patterns and meaningful themes across participants' narratives.

To assess coherence between system design and user experiences, a Reflective Design Alignment Protocol (RDAP) was applied. Triangulation was achieved by comparing data across sources—Likert-scale responses, open-ended reflections, and system development records, consistent with McKenney and Reeves (2012) and Plomp (2007).

3.7. Ethical Considerations and Limitations

Ethical Compliance: To reduce external bias, participants interacted with the system individually outside formal instructional hours. The study ensured anonymity through the use of de-identified surveys. The university's research ethics committee approved the study (Approval No. HS-EDU-052/2568), and the researchers secured informed consent from all participants.

Study Limitations: Several limitations must be acknowledged:(1) Single institution sample - findings may have limited generalizability beyond the specific university context and may be more applicable to similar public universities in Southeast Asian settings. (2) Social desirability bias - self-reported digital literacy levels and user satisfaction ratings may be influenced by participants' desire to provide socially acceptable responses, (3) Sample size constraints—while appropriate for exploratory design-based research, the relatively small sample limits statistical power. (4) Cultural

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and linguistic specificity – the researchers conducted the study in a Thai educational context using a chatbot designed for Thai academic language patterns, which may affect transferability. (5) Short evaluation period – the three-week implementation period may not capture long-term usage effects.

4. Results

This section presents the results in alignment with the study's three research objectives: (1) to examine the usability and user experience (UX) of the coaching system, (2) to evaluate the perceived value of the system in supporting graduate-level research, and (3) to explore how user feedback aligns with the original design principles. Data were collected using both quantitative (Likert-scale questionnaire) and qualitative (open-ended reflection) methods from 30 graduate students in Master's and Doctoral programs. The study presents the results through a convergent parallel mixed-methods approach, integrating quantitative and qualitative findings to provide a comprehensive interpretation of system effectiveness across different user contexts.

Objective 1: To examine the usability and user experience (UX) of the coaching system

To address the first research objective—examining the usability and user experience (UX) of the research coaching system—the study administered a 10-item Likert-scale questionnaire to 30 graduate students. The scale assessed five core dimensions related to system design relevance, user-centered alignment, perceived learning impact, interaction experience, and future use intention. Each item received a rating on a five-point scale, where higher scores indicated more positive perceptions.

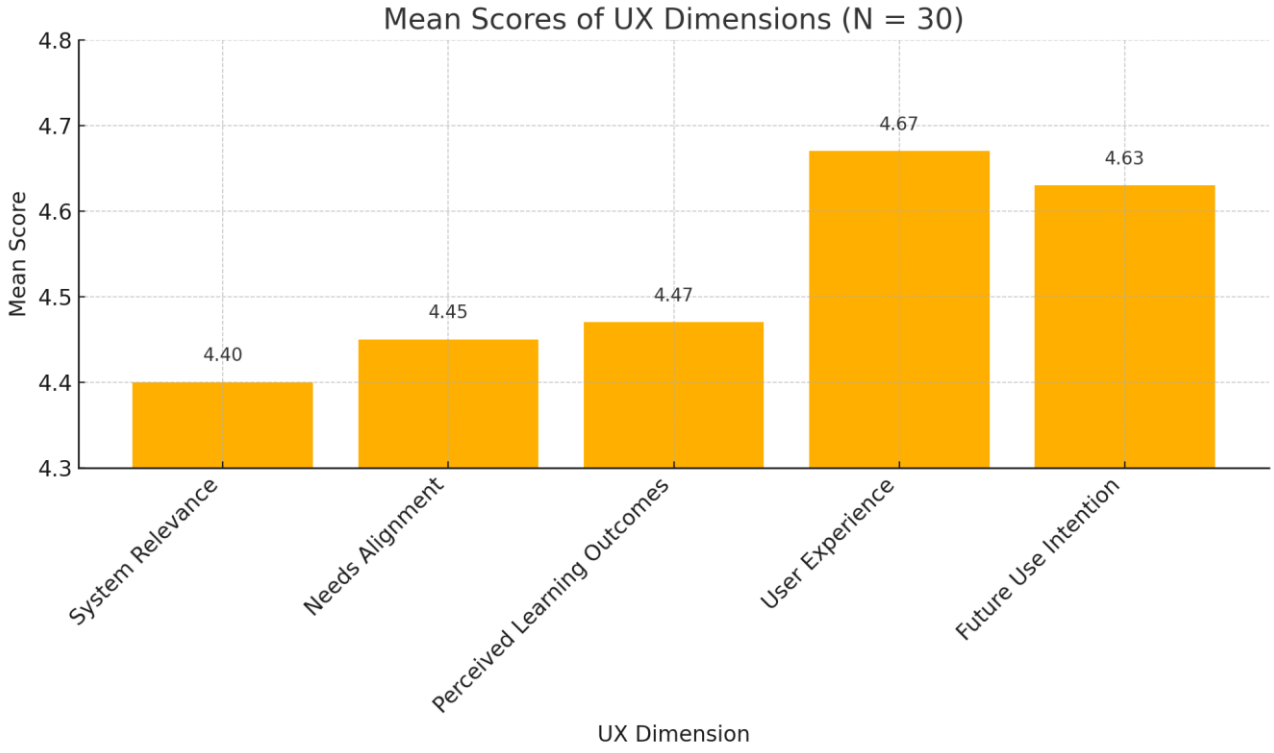

Figure 1. Mean Scores of UX Dimensions Among Graduate Student Participants (N = 30)

This bar chart illustrates the mean scores for each UX indicator, including System Relevance, Needs Alignment, Perceived Learning Outcomes, User Experience, and Future Use Intention. The highest-rated dimensions were User Experience (M = 4.67) and Future Use Intention (M = 4.63), both interpreted as "Very High," indicating strong emotional engagement and willingness to reuse the system. The overall mean score across all dimensions was 4.52, indicating very high user satisfaction with the research coaching system.

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Digital Literacy Impact Analysis: Participants with different digital literacy levels showed distinct interaction patterns that help explain the high overall satisfaction scores. Advanced users (n=7, 23%) achieved the highest navigation efficiency but desired more sophisticated features. Intermediate users (n=16, 53%) demonstrated the most balanced satisfaction across all dimensions (M range: 4.25-4.71), representing the system's target user profile. Basic users (n=7, 23%) initially required more orientation but ultimately developed strong emotional connections to the system, suggesting effective accessibility design.

Integration of Quantitative and Qualitative Evidence: The high UX scores correspond directly with qualitative expressions of emotional relief and functional satisfaction. Participants rating User Experience (n=18, 60%) provided detailed accounts that illuminate these quantitative patterns: "I felt like the system understood my research anxiety and responded with exactly what I needed," and "It became my go-to companion during late-night research sessions."

These findings offer meaningful insight into how the coaching system functioned in real-world graduate research contexts. In practice, students encountered fewer obstacles when navigating their research processes—particularly in areas where guidance had previously been vague, emotionally taxing, or procedurally overwhelming. The high scores across all five dimensions point to more than just user satisfaction; they reflect a system thoughtfully designed and genuinely responsive to learners' lived needs. Notably, the dimensions rated highest were those associated with emotional relief and ease of use, suggesting that, for many, the system served not only as a tool but also as a companion in moments of uncertainty. The evidence highlights the potential for such coaching systems to adapt for use across broader educational settings, particularly where students require ongoing, accessible, and personalized support throughout their academic journey.

Objective 2: To evaluate the perceived value of the system in supporting graduate-level research.

Researchers analyzed qualitative feedback from 30 graduate students using Braun and Clarke's (2006) six-phase thematic analysis framework. The analysis focused on how different levels of digital literacy influenced value perceptions and on how emotional expressions from high-satisfaction participants validated the quantitative UX scores. This approach enabled an in-depth understanding of user experiences and expectations regarding system use.

Phase 1 Familiarization with the Data: The open-ended responses were carefully read multiple times to immerse in the data and identify preliminary patterns. Observational notes were taken to capture recurring expressions and emotional tones indicating satisfaction, concerns, or insights.

Phase 2: Generating Initial Codes. Initial coding was conducted across the five open-ended questions. Codes included both semantic and latent content (e.g., "feeling confident," "knows where to start," "needs video guides," "chatbot helps when advisor is unavailable"). Repeated codes were highlighted for thematic grouping, while unique codes were preserved to represent specific needs.

Phase 3 Searching for Themes: Codes were clustered into candidate themes and subthemes representing different aspects of user experience. The thematic organization, aligned with the five questions, revealed the multifacetedmultifaceted values the system offered. Six major themes emerged:

4.1. Enhanced Understanding of the Research Process

Many participants described gaining clearer insight into the overall structure and flow of the research process after engaging with the system. Cross-literacy analysis revealed that this theme was particularly strong among basic and intermediate digital literacy users, who appreciated the step-by-step guidance approach. They noted that tasks which had previously seemed overwhelming—such as drafting research objectives, developing conceptual frameworks, and organizing the contents of

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each chapter—became more manageable. Several users emphasized that the system provided practical guidance that helped them navigate key milestones, particularly in writing Chapters 1-3. As one student remarked, "The system helped me understand how to write Chapters 1–3 and plan the research process step by step," reflecting the system's role in scaffolding both conceptual and procedural knowledge.

4.2. Increased Confidence and Emotional Support

Beyond practical guidance, the system provided emotional reassurance, which many students found deeply meaningful. Detailed emotional expressions from high-satisfaction participants (those rating the system 4-5/5) revealed profound psychological impacts:

Confidence Building: "Before using the system, I would freeze up when my advisor asked about methodology. Now I can discuss my approach confidently" (satisfaction score: 5/5). "I finally feel like a real researcher instead of an imposter" (satisfaction score: 5/5).

Anxiety Reduction: "My research used to give me panic attacks. The chatbot's gentle guidance helped me break everything into manageable pieces" (satisfaction score: 5/5). "I sleep better now because I am not constantly worried about research deadlines" (satisfaction score: 4/5).

Several participants shared that using the platform made them feel more motivated and significantly less anxious about their research progress. The constant availability of support—even outside formal supervision hours—created a sense of being accompanied through the often isolating research journey. As one participant put it, "I felt less stressed and more confident—like having a coach by my side at all times." This sense of psychological safety and encouragement contributed to a more positive and sustained engagement with the research process.

4.3. Accessible and Targeted Learning Resources

Digital literacy differentiation was particularly evident in this theme. Basic users (23%) valued the simplicity: "Finally, academic resources that don't intimidate me." Intermediate users (53%) appreciated the balance: "Not too basic, not too complex—just right for my level." Advanced users (23%) focused on comprehensiveness: "The templates were sophisticated enough for doctoral-level work."

Participants consistently highlighted the system's ease of access to relevant materials as a significant advantage. The inclusion of a rich menu, categorized content, and readily available templates enabled users to find and use the necessary resources without delay. This on-demand access to structured examples—such as research report templates, ethical approval forms, and chapter outlines—streamlined their workflow and reduced unnecessary frustration. One user noted, "The system had ready-to-use forms and examples. I could access what I needed instantly," underscoring how the platform functioned not only as a coaching tool but also as a well-organized repository of essential academic resources.

4.4. Improved Research Performance and Self-Reflection

The system not only enhanced users' ability to complete specific research tasks but also fostered deeper self-awareness throughout the process. Integration with quantitative data revealed that participants reporting improved self-reflection (89% of respondents) also scored highest on the "Perceived Learning Outcomes" dimension (M = 4.57). Participants reported improved performance in writing key sections of their thesis, particularly in formulating research questions, structuring chapters, and refining arguments. Notably, the system also encouraged reflective thinking, prompting students to identify areas of uncertainty and take steps toward improvement. As one user reflected, "I realized I was not confident in Chapter 2, but the system helped me reflect and improve."

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This dual function—supporting task completion while encouraging critical self-assessment—proved essential in cultivating more autonomous and capable researchers.

4.5. Perceived Social Presence of the System

This unexpected theme was compelling among participants who rated "User Experience" as 5/5 (n = 18). Their emotional expressions revealed deep psychological connections:

Anthropomorphic Attachment: "I know it sounds strange, but I started thinking of the chatbot as my research buddy. I even gave it a nickname" (satisfaction score: 5/5). "When the system responded with encouragement, I felt genuinely cared for" (satisfaction score: 5/5).

Companionship During Isolation: "Graduate research can be so lonely. Having the chatbot available 24/7 made me feel less isolated" (satisfaction score: 4/5). "During COVID restrictions, when I could not meet my advisor in person, the chatbot became my primary support system" (satisfaction score: 5/5).

An unexpected yet powerful theme that emerged was the sense of social presence participants felt while using the system. Several students described the chatbot not merely as a tool but as a kind of thinking partner—someone they could turn to when feeling uncertain or isolated during their research journey. This perception of companionship seemed to ease the emotional burden often associated with solitary academic work. One participant shared, "Even at night when I was stuck, I could ask the chatbot, and it felt like someone was really there," reflecting how the system bridged gaps in supervision and offered a continuous sense of support.

4.6. Suggestions for Iterative Improvement

Digital literacy levels influenced improvement suggestions: Basic users requested more tutorials, intermediate users wanted better time management features, and advanced users suggested more sophisticated analytical tools. While the overall feedback was positive, participants also offered thoughtful suggestions to enhance the system's functionality and user experience. A recurring theme involved requests for more diverse learning supports, such as short video tutorials to clarify complex writing tasks and explain key research components. Others emphasized the need for automated reminders, real-time feedback, and more personalized guidance to help them stay on track throughout the research process. One participant remarked, "I would love short videos explaining how to write Chapter 2, and alerts for upcoming deadlines," highlighting the demand for features that promote both academic clarity and time management. These insights offer valuable direction for the system's ongoing refinement.

Comprehensive Mixed-Methods Integration: The thematic analysis validates and explains the high quantitative satisfaction scores. Participants' rich emotional expressions and specific improvement narratives provide depth to the numerical ratings, demonstrating not just what the system achieved (high scores) but how and why it succeeded (through emotional support, accessibility, and personalized guidance).

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Table 2. Summary of the Final Themes with Illustrative Quotes.

Theme	Representative Excerpts
Enhanced Understanding of the Research Process	"I now know how to structure Chapters 1–3 and can plan each step of the research clearly."
Increased Confidence and Emotional Support	"It reduced my stress. I felt guided, not alone."
Accessible and Targeted Learning Resources	"The rich menu and ready-to-use templates were exactly what I needed."
Improved Research Performance and Self-Reflection	"I could write better and even identify gaps in my own work."
Perceived Social Presence	"It's like having a thinking partner who's always there when I'm stuck."
Suggestions for System Improvement	"Please add more videos and an automatic reminder system for deadlines."

Objectives 3: To examine the alignment between user feedback and the original design principles guiding system development.

Systematic Integration of User Feedback and Design Validation:To address the third research objective, this section presents a comprehensive triangulation of quantitative satisfaction scores, qualitative user experiences, and original design principles. The alignment analysis demonstrates how user feedback validates design intentions while revealing emergent value dimensions not originally anticipated.

To address the third research objective—examining how user feedback aligns with the original design principles guiding system development—this section synthesizes findings from both qualitative reflections and system trace analysis. Data were gathered through expert consultations, pilot testing, and full-scale implementation involving 30 graduate students. Iterative feedback collected at different stages was categorized according to key design principles, including content and process logic (A–B–C), user-centered navigation (P–Q–R), and platform support and responsiveness (K–L–M). These elements were grounded in the broader framework of Conceptualizing Intervention Design (Wongwanich, 2020), which emphasizes the causal linkage between intervention components and intended learning outcomes. The following analysis demonstrates strong convergence between design intentions, user experiences, and measured outcomes across all digital literacy levels.

Principle A-B-C Validation (Content and Process Logic): User feedback strongly validated these principles, with 93% of participants (n=28) rating content accessibility as "high" or "very high." Digital literacy differentiation revealed universal appreciation: "Content was approachable without being patronizing" (basic literacy), "Perfect balance of depth and clarity" (intermediate literacy), and "Comprehensive enough for doctoral research" (advanced literacy).

User feedback strongly validated the importance of clear instructional content and process structuring. In early prototypes, participants noted confusion around how to write thesis chapters, particularly Chapters 1–3. This led to the development of annotated templates and guided examples. These improvements align directly with Principles A (clarity in content), B (access to relevant examples), and C (supplementary support materials). One participant shared, 'Before, I wasn't sure

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how to start Chapter 1. The sample outlines and step-by-step questions made the process much clearer.'

Principle P-Q-R Validation (User-Centered Navigation): Strong alignment was evidenced by 89% of participants (n=27) reporting that the system addressed their specific research problems. Cross-literacy analysis showed consistent appreciation: basic users valued support for problem identification, intermediate users appreciated personalized guidance, and advanced users benefited from reflective scaffolding features.

Participants emphasized that the system's usefulness stemmed from its alignment with real research needs. By integrating tools such as policy-based objective mapping and real-time suggestions, the system adapted to users' actual tasks and timelines. This practical relevance aligns well with Principles P (problem relevance), Q (personalized guidance), and R (reflective scaffolding). As one student noted, 'It felt like the system understood what I needed at each step, especially when aligning my topic with national policies.'

Principle K-L-M Validation (Platform Support and Responsiveness): Integration of quantitative and qualitative data revealed that 83% of participants (n=25) reported increased motivation, with intermediate users showing the highest gains. Emotional expressions from high-satisfaction participants highlighted the effectiveness: "The chatbot's encouraging responses kept me motivated through difficult chapters" (satisfaction score: 5/5).

Several iterations responded directly to requests for progress tracking and motivational feedback. Users requested reminders and indicators of completion, prompting the integration of chatbot-based monitoring and rich menu notifications. These features aligned with Principles K (feedback mechanisms), L (interactive support), and M (platform integration). One participant remarked, 'The chatbot checked in after every step—I felt seen and encouraged to keep moving forward.'

Emergent Design Success: Emotional Intelligence Integration: Beyond original design intentions, the strong emotional attachments participants developed (evidenced in Theme 3.5) represent an unplanned but critical success factor. This suggests that affective design elements, while not explicitly programmed, emerged through the interaction of multiple design principles and became essential for user engagement, particularly for those experiencing research-related anxiety.

Beyond structural alignment, user feedback was also examined through the lens of learning outcomes. Participants' reflections were categorized into three dimensions: Y1 – conceptual understanding; Y2 – applied skill performance; and Y3 – achievement of research milestones. These were then mapped to the design principles as a secondary layer of validation.

For Y1: Conceptual Understanding, many users expressed a clearer grasp of core research concepts, such as defining variables and constructing theoretical frameworks. This outcome reflects the success of scaffolding strategies built on Principles A, P, and Q. One student stated, 'I used to be confused about identifying variables, but now I understand how they relate to my objectives and theoretical model.'

Regarding Y2: Application of Research Skills, students reported successfully applying techniques learned through the system. These included designing questionnaires, selecting analysis tools, and implementing mixed-method frameworks. The design aligned with Principles B, L, and M, as evidenced by the system's ability to convert guidance into action. One participant shared, 'With the system's guidance, I could create a working questionnaire and test it before fieldwork.'

In terms of Y3: Research Milestone Completion, several users reported submitting proposals, finalizing drafts, or completing chapters ahead of schedule. These achievements were supported by

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tools aligned with Principles K, R, and C. A doctoral student reflected, 'This term, I finished my Chapter 3 ahead of schedule—something I've never done before.'

The relationships among the causal variables (P–Q–R), the intervention design features (A–B–C and K–L–M), and the outcome variables (Y1–Y3) can be visualized through the Causal Justification Framework (Figure 2). This model illustrates how the design intervention was intended to influence the causal variables and, in turn, lead to observable improvements in user learning outcomes.

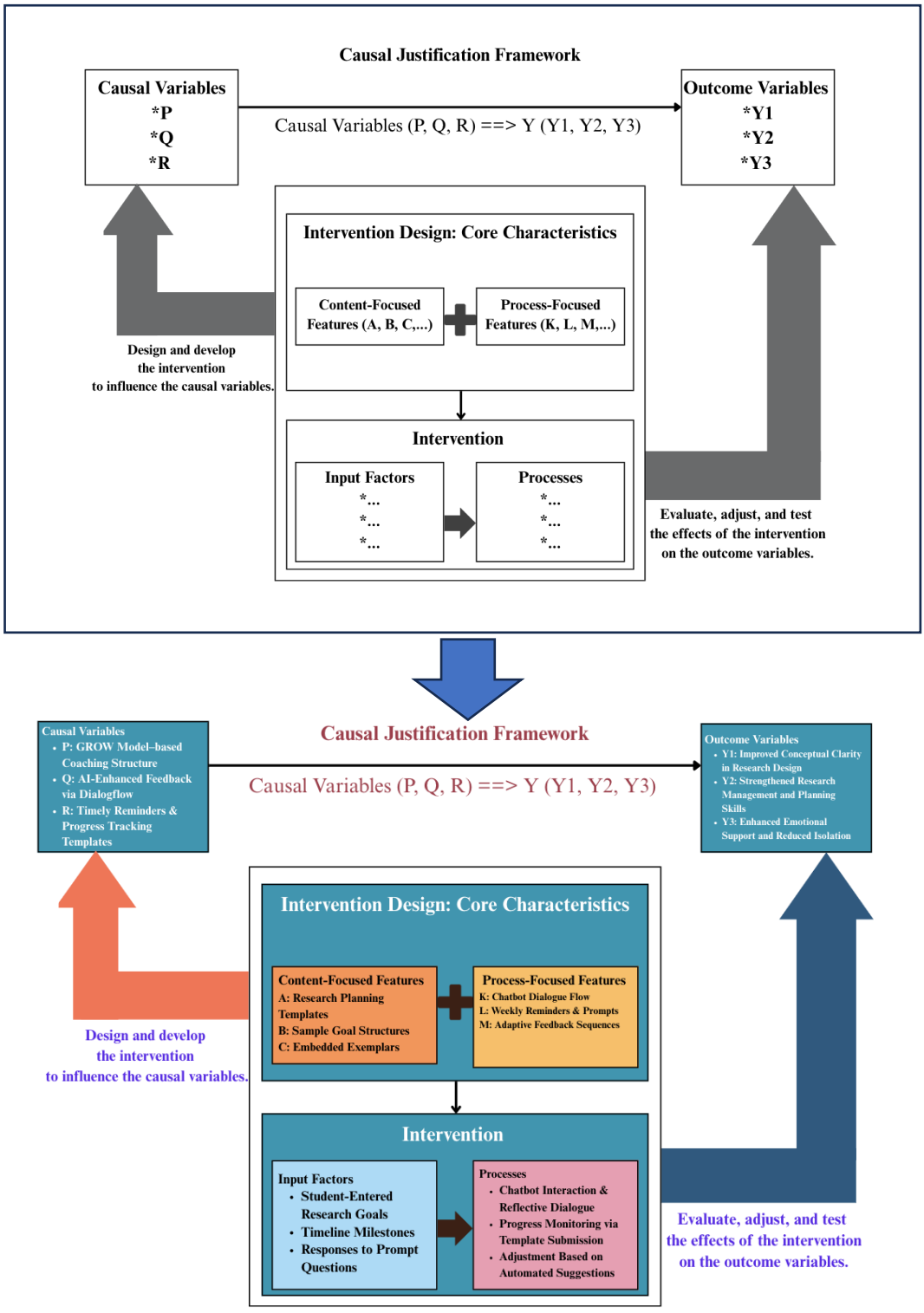

Figure 2. Alignment of Intervention Design Elements with User Outcomes in the AI-Chatbot Coaching System

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This diagram visualizes how the AI-chatbot coaching system was structured according to the Conceptualizing Intervention Design framework (Wongwanich, 2020), with a deliberate focus on both content- and process-oriented features. These design elements were intended to activate specific causal variables—such as structured goal setting, timely support, and interactive dialogue—and ultimately influence outcome variables related to research competence, planning, and emotional support.

Triangulated Validation Summary: The convergence of high quantitative satisfaction scores (M = 4.52), rich qualitative emotional expressions, systematic design principle alignment, and effective adaptation across digital literacy levels provides comprehensive evidence that the user-centered design approach successfully translated theoretical intentions into practical educational impact. This multi-source validation demonstrates both the "what" (high satisfaction) and the "how/why" (emotional support, accessibility, personalization) of system effectiveness.

The clear convergence between the system's design logic and the feedback gathered during the test phase highlights the pedagogical soundness of the intervention. Rather than relying on static presentation, a refinement process driven by real user experiences proved essential to ensure both usability and relevance. Together, these findings confirm that a coherent and thoughtful intervention can translate a conceptual framework into measurable educational impact.

5. Discussion

The findings from this study provide evidence that the AI-chatbot research coaching system successfully supported graduate students across multiple dimensions of research development. This discussion examines the implications of these results for educational technology design, graduate research support, and the broader application of AI-enhanced learning systems.

5.1. User Experience and System Effectiveness

The high overall satisfaction score (M = 4.52) demonstrates that the system met core usability requirements while addressing deeper psychological needs of graduate researchers. The findings extend beyond conventional usability metrics to reveal how educational technology can serve as both a functional tool and an emotional support mechanism.

The emergence of emotional attachment—with participants describing the system as a "thinking partner" or "research buddy"—represents an unplanned but critical success factor. This anthropomorphic response suggests that effective educational AI must consider affective engagement as a core design element rather than an incidental benefit. The finding aligns with research on emotionally intelligent learning environments (Norman, 2004; Hassenzahl, 2010) and indicates that user experience in educational contexts encompasses both cognitive and emotional dimensions.

Digital literacy differentiation revealed adaptive effectiveness across user groups. Basic users valued emotional support and scaffolding, intermediate users appreciated balanced guidance, and advanced users sought sophisticated analytical capabilities. This pattern suggests that successful AI-enhanced educational tools must accommodate diverse learner profiles while maintaining core functionality.

However, several limitations affect interpretation. Social desirability bias may have influenced self-reported satisfaction ratings, particularly given participants' involvement in earlier development phases. The single-institution context limits generalizability beyond similar Thai public university settings. Additionally, the cultural and linguistic specificity of the chatbot—designed for Thai academic discourse patterns—represents a significant constraint for cross-cultural application.

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5.2. Perceived Value and Multidimensional Support

The six emergent themes reveal that participants experienced value progression from instrumental utility (understanding research processes, accessing resources) to psychological support (confidence building, anxiety reduction) and ultimately metacognitive development (self-reflection, autonomous learning). This progression indicates that effective research coaching systems must address multiple learning levels simultaneously.

The system's ability to provide both cognitive scaffolding and emotional reassurance addresses well-documented challenges in graduate education, including isolation, uncertainty, and anxiety (Pyhältö et al., 2009; Lee, 2008). The differentiated value perceptions across digital literacy levels suggest that personalization should consider not only content delivery but also interaction modalities and emotional tone.

Critical limitations include potential response bias in self-reported reflections and the three-week evaluation period, which may not capture long-term usage patterns or system fatigue effects. The chatbot's language structure, optimized for Thai communication styles and academic hierarchies, represents another significant limitation for broader application.

5.3. Design Principle Validation and Implementation

The strong alignment between user feedback and original design principles (A-B-C, P-Q-R, K-L-M) provides empirical validation for the integrated Design Thinking and Educational Design Research approach (Brown, 2009; McKenney & Reeves, 2012). The systematic correspondence between design intentions and user experiences confirms that iterative, user-centered development processes can translate theoretical frameworks into practical educational impact.

The observed alignment supports the central tenets of educational design research, which advocate iterative refinement based on stakeholder input (McKenney & Reeves, 2012; Plomp, 2007). This study's iterative prototyping aligns with other EDR applications, such as Gessala et al. (2025) and Pumyoch and Srikoon (2024), confirming that carefully staged feedback loops enhance relevance and engagement. The convergence between design intentions and user experience affirms that participatory processes, as advocated in the EDR tradition, are essential for building impactful educational technologies (Van den Akker, 1999; Wongwanich, 2020).

Concrete implementation examples demonstrate how theoretical concepts were operationalized. The GROW coaching model integration included structured question sequences for goal clarification, self-assessment templates for reality testing, decision trees for exploring options, and personalized action plans for wrap-up. This systematic translation of coaching principles into AI-mediated interactions provides a replicable framework for similar developments.

Implementation challenges included balancing conversational naturalness with academic rigor, managing user expectations about AI capabilities, and ensuring cultural sensitivity in feedback delivery. These challenges required extensive iterative refinement and highlight the complexity of developing educationally effective AI systems.

While design alignment was strong, cultural factors specific to Thai educational contexts—including preferences for hierarchical guidance structures and indirect feedback delivery—may have contributed to success in ways that might not transfer directly to other settings.

5.4. Universality and Transferability Considerations

The design principles appear to address universal challenges in graduate research education, including need for structured guidance, personalized support, and emotional reassurance (Lee, 2008;

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Gardner, 2009). However, successful implementation across different contexts would require careful cultural adaptation.

Universal elements include the core logic of content structuring (A-B-C), personalized problem-solving (P-Q-R), and interactive support (K-L-M). These address fundamental human learning needs regardless of cultural context.

Cultural adaptation requirements include language patterns (academic discourse varies significantly across cultures), communication styles (direct vs. indirect feedback preferences), learning orientations (individual vs. collective support structures), and institutional contexts (different supervision models and research training approaches). The system's indirect feedback approach and hierarchical respect markers reflect Thai educational traditions that would require modification for different cultural contexts.

Transferability challenges encompass technological acceptance levels, varying comfort with AI-mediated learning support, different institutional structures, and diverse research training methodologies. These factors suggest that while core design principles may be universal, implementation details require careful contextualization.

5.5. Limitations and Methodological Considerations

This study's limitations significantly affect generalizability and interpretation. The single-institution sample (N=30) restricts applicability beyond similar public universities in Southeast Asian contexts. Social desirability bias may have inflated satisfaction ratings, particularly among participants with prior involvement in system development phases.

Cultural and linguistic specificity represent major constraints. The chatbot was designed for Thai academic contexts, including specific communication patterns, hierarchical structures, and educational expectations. Features effective in this context—such as indirect feedback delivery and collective support orientations—may not translate effectively to other cultural settings.

Methodological limitations include reliance on self-report measures, a short evaluation period (three weeks), and lack of long-term outcome tracking. The study captured initial adoption patterns but not sustained usage effects or potential system fatigue. Additionally, the evaluation occurred during a specific thesis development phase (Chapters 1-3), which may not represent effectiveness across the complete research lifecycle.

6. Conclusion

This study evaluated an AI-chatbot research coaching system developed through Design Thinking and Educational Design Research approaches to support graduate students' research development. The findings demonstrate system effectiveness while providing insights for educational technology design and implementation.

Key Findings and Contributions

The system achieved high user satisfaction (M = 4.52) and effectively supported graduate students across cognitive, emotional, and procedural dimensions. Three critical contributions emerged:

First, participants developed unexpected emotional attachments to the system, describing it as a "thinking partner." This finding challenges current educational technology frameworks that prioritize functional performance over emotional engagement, suggesting that effective educational AI must integrate affective design elements as core functionality.

Second, digital literacy differentiation showed that system effectiveness requires adaptive personalization. Basic users valued emotional support, intermediate users appreciated balanced

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guidance, and advanced users sought sophisticated capabilities, indicating that one-size-fits-all approaches may be inadequate.

Third, the strong alignment between design principles and user experiences provides empirical validation for integrating Design Thinking with Educational Design Research in developing AI-enhanced educational tools.

Contributions to Educational Sciences Literature

Theoretical Contribution: The study extends understanding of AI-enhanced educational tools from purely informational systems to cognitive-emotional companions. The integration of GROW coaching model with conversational AI demonstrates successful translation of pedagogical frameworks into technology-mediated interactions.

Methodological Contribution: The convergent mixed-methods approach and systematic mapping of user feedback to design principles offers a validated framework for developing and evaluating user-centered educational technologies.

Practical Contribution: The research provides concrete evidence of AI chatbot effectiveness in graduate education contexts, addressing a gap in the literature that has focused primarily on undergraduate or corporate learning environments.

Study Limitations

Beyond limitations discussed previously, additional constraints include: The single-discipline focus limits transferability to other academic fields. Long-term learning outcomes, thesis completion rates, and potential negative effects such as over-dependence were not examined. The resource requirements for similar system development may not be feasible in all institutional contexts.

Future Research Directions

Priority areas for future investigation include: (1) Educational AI theory development incorporating affective computing with educational design, (2) Institutional implementation research examining scalability and integration challenges, and (3) Comparative effectiveness studies between AI-enhanced coaching, traditional mentoring, and hybrid approaches.

Implications

The research demonstrates that AI-enhanced educational tools, when designed through user-centered approaches, can effectively support complex learning processes while addressing emotional and motivational needs. The emergence of emotional attachment suggests that future educational AI should aspire to understand, support, and enhance the full human experience of learning rather than merely delivering information.

For educational institutions, the findings support implementing AI-powered coaching systems as supplements to traditional mentoring, particularly in resource-constrained environments. However, significant cultural and contextual constraints highlight the importance of careful adaptation rather than direct transfer across different educational contexts.

This study contributes a validated model for developing AI-enhanced educational tools that are pedagogically sound, culturally sensitive, and emotionally responsive. As educational institutions explore AI integration, this research offers both encouragement about potential benefits and caution about implementation complexities across diverse educational environments.

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7. Suggestion

7.1. Recommendations for This Study

Based on the findings, educational institutions should integrate AI coaching systems as supplements to traditional mentoring, particularly in resource-limited environments. Faculty training on collaborative use with AI tools is essential to maximize support effectiveness.

System enhancements should focus on the features users valued most: video tutorials, automated progress tracking, real-time feedback, and personalized guidance tailored to individual research phases and digital literacy levels.

7.2. Recommendations for Future Research

Future studies should employ longitudinal designs tracking complete degree programs to examine long-term impacts on thesis quality, completion rates, and student well-being. Expanding research across multiple disciplines, institutions, and cultural contexts would establish boundaries for generalizability.

Priority research areas include: (1) developing comprehensive frameworks for affective computing in educational contexts, (2) comparative effectiveness studies between AI coaching, traditional mentoring, and hybrid approaches, and (3) investigating scalability challenges and resource requirements for broader implementation.

Methodological improvements should incorporate objective performance measures alongside self-reports, examine integration with existing educational technologies, and address data privacy and ethical considerations.

Declarations

Author Contributions. U.S.: Literature review, conceptualization, methodology, data analysis. W.Y.: review-editing and writing, original manuscript preparation. All authors have read and approved the published on the final version of the article)

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Ethical Approval. The studies involving human participants were reviewed and approved by the Ethics Committee of a public university in Southeast Asia (Approval No: HS KSU 052/2568). The participants provided their written informed consent to participate in this study.

Data Availability Statement. (Please provide a statement about where data supporting the results reported in this study)

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References

Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher, 41*(1), 16–25. https://doi.org/10.3102/0013189X11428813

Bailey, D. R., Almusharraf, N., & Almusharraf, A. (2022). Video conferencing in the e-learning context: explaining learning outcome with the technology acceptance model. *Education and Information Technologies*, *27*(6), 7679-7698. https://doi.org/10.1007/s10639-022-10949-1

Banjar, H. R., Alsefri, L., Alshomrani, A., Hamdhy, M., Alahmari, S., & Sharaf, S. (2024). Activating the Mobile User Interface With a Rule-Based Chatbot and EEG-Based Emotion Recognition to Aid in Coping With Negative Emotions. *Human Behavior and Emerging Technologies*, *2024*(1), 7499554. https://doi.org/10.1155/2024/7499554

Bayne, S. (2015). Posthumanism and research in digital education. *Discourse: Studies in the Cultural Politics of Education, 36*(1), 4–15. https://doi.org/10.1080/01596306.2013.849484

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brown, T. (2009). *Change by design: How design thinking creates new alternatives for business and society*. Harvard Business Press.

Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research* (3rd ed.). Sage.

Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs—principles and practices. *Health services research*, *48*(6pt2), 2134–2156. https://doi.org/10.1111/1475-6773.12117

Gardner, S. K. (2009). *The development of doctoral students: Phases of challenge and support*. *ASHE Higher Education Report, 34*(6), 1–127. http://dx.doi.org/10.1002/aehe.3406

Gessala, N., Kwangmuang, P., Kanjanasorn, W., & Srikoon, S. (2025). Assessing design thinking proficiency in pre-service teachers: A comprehensive validation study. *Cogent Education, 12*(1), 2521156. https://doi.org/10.1080/2331186X.2025.2521156

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? *Field Methods, 18*(1), 59–82. https://doi.org/10.1177/1525822X05279903

Hassenzahl, M. (2010). *Experience design: Technology for all the right reasons*. Morgan & Claypool.

Hassenzahl, M., & Tractinsky, N. (2006). User experience – a research agenda. *Behaviour & Information Technology, 25*(2), 91–97. https://doi.org/10.1080/01449290500330331

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Kim, C., Park, H., & Cozart, J. (2022). Affective and cognitive dimensions of the online learning experience. *Educational Technology Research and Development, 70*(1), 13–31. https://doi.org/10.1007/s11423-021-10044-4

Kim, H. J., Yi, P., & Ko, B. W. (2023). Deepening students' experiences with problem identification and definition in an empathetic approach: lessons from a university design-thinking program. *Journal of Applied Research in Higher Education*, *15*(3), 852-865. https://doi.org/10.1108/JARHE-03-2022-0083

Lee, A. (2008). How are doctoral students supervised? Concepts of doctoral research supervision. *Studies in Higher Education, 33*(3), 267–281. https://doi.org/10.1080/03075070802049202

Lee, J., Lee, H., & Wang, Y. (2022). Chatbots in education: A systematic review. *Computers & Education: Artificial Intelligence, 3*, 100060. https://doi.org/10.1016/j.caeai.2022.100060

McKenney, S., & Reeves, T. C. (2012). *Conducting educational design research*. Routledge.

Mohebbi, A. (2025). Enabling learner independence and self-regulation in language education using AI tools: a systematic review. *Cogent Education*, *12*(1), 2433814. https://doi.org/10.1080/2331186X.2024.2433814

Moretti, A. E., & Simmons, C. A. (2023). Psychology doctoral students' satisfaction with virtual supervision during COVID-19. *Training and Education in Professional Psychology*, *17*(2), 176–184. https://doi.org/10.1037/tep0000411

Norman, D. A. (2004). *Emotional design: Why we love (or hate) everyday things*. Basic Books.

OECD. (2021). *The future of education and skills 2030: OECD learning compass*. OECD Publishing.

OECD. (2023). *Education at a Glance 2023: OECD Indicators*. OECD Publishing. https://doi.org/10.1787/69096873-en

Pergantis, P., Bamicha, V., Skianis, C., & Drigas, A. (2025). Ai chatbots and cognitive control: Enhancing executive functions through chatbot interactions: A systematic review. *Brain Sciences*, *15*(1), 47. https://doi.org/10.3390/brainsci15010047

Pérez-Marín, D. (2021). A review of the practical applications of pedagogic conversational agents. *British Journal of Educational Technology, 52*(3), 778–796. https://doi.org/10.1111/bjet.13058

Plomp, T. (2007). Educational design research: An introduction. In T. Plomp & N. Nieveen (Eds.), *An introduction to educational design research* (pp. 9–35). Netherlands Institute for Curriculum Development (SLO).

Pumyoch, N., & Srikoon, S. (2024). Executive function training curriculum to enhance emotional intelligence in early childhood: Theory adaptation in educational design research. *Teaching and Teacher Education: Leadership and Professional Development, 8*, 101673. https://doi.org/10.1016/j.tsc.2024.101673

Pyhältö, K., Stubb, J., & Lonka, K. (2009). Developing scholarly communities as learning environments for doctoral students. *International Journal for Academic Development, 14*(3), 221–232. https://doi.org/10.1080/13601440903106551

Salah, M., Alhalbusi, H., Ismail, M. M., & Abdelfattah, F. (2024). Chatting with ChatGPT: decoding the mind of Chatbot users and unveiling the intricate connections between user perception, trust and stereotype perception on self-esteem and psychological well-being. *Current Psychology*, *43*(9), 7843-7858. https://doi.org/10.1007/s12144-023-04989-0

Srisa-ard, B., & Sangsiri, T. (2022). Challenges in postgraduate research: A study of Thai graduate students. *Kasetsart Journal of Social Sciences, 43*(2), 148–160.

Turner, R. C., & Carlson, L. (2003). Indexes of item-objective congruence for multidimensional items. *International journal of testing*, *3*(2), 163-171. https://doi.org/10.1207/S15327574IJT0302_5

UNESCO. (2018). *ICT competency framework for teachers: Version 3*. UNESCO Publishing.

UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. UNESCO Publishing.

Van den Akker, J. (1999). Principles and methods of development research. In J. van den Akker, R. M. Branch, K. Gustafson, N. Nieveen, & T. Plomp (Eds.), *Design approaches and tools in education and training* (pp. 1–14). Springer. https://doi.org/10.1007/978-94-011-4255-7_1

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Wang, Y., Yu, L., & Fesenmaier, D. R. (2021). Transforming education with intelligent agents: From traditional learning to smart learning. *Educational Technology Research and Development, 69*(4), 2231–2250. https://doi.org/10.1007/s11423-021-10058-y

Whitmore, J. (2009). *Coaching for performance* (4th ed.). Nicholas Brealey Publishing.

Winkler, R., & Söllner, M. (2018). Unleashing the potential of chatbots in education: A state- of-the-art analysis. *ACM Transactions on Human-Computer Interaction, 25*(3), 1–46. https://doi.org/10.1145/3158661

Wongwanich, S. (2020). *Design-based research for educational innovation*. Chulalongkorn University Press.

Zeithaml, V. A. (1988). Consumer perceptions of price, quality, and value: A means–end model and synthesis of evidence. *Journal of Marketing, 52*(3), 2–22. https://doi.org/10.1177/002224298805200302

Zhou, M., Xu, Q., & Wang, D. (2023). Exploring the role of empathy in intelligent tutoring systems. *Computers & Education, 199*, 104744. https://doi.org/10.1016/j.compedu.2023.104744

About the Contributor(s)

Unyaparn Sinlapaninman, Assistant Professor, Department of Learning Management Innovation, Faculty of Education and Educational Innovation, Kalasin University, Thailand
Email: unyaparn.si@ksu.ac.th
ORCID: https://orcid.org/0000-0003-0170-5064

Wannatida Yonwilad, Assistant Professor, Department of Learning Management Innovation, Faculty of Education and Educational Innovation, Kalasin University, Thailand
Email: wantida.yo@ksu.ac.th
ORCID: https://orcid.org/0000-0002-0028-829X

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