

Designing for the Unspoken: A Work-in-Progress on Tacit Knowledge Transfer in High-Stress Public Institutions

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Abstract

Tacit knowledge, an unspoken, experience-based understanding that supports professional expertise, plays a critical role in high-stress public institutions such as corrections, emergency, and security services. This knowledge, however, is difficult to capture and transfer, leading to substantial knowledge loss during personnel onboarding and offboarding. This research explores how tacit knowledge can be systematically supported by firstly investigating real-world practices and needs, secondly designing a voice-controlled auditory assistant, and finally developing or refining a supporting theoretical framework.

Grounded in a scoping review of 55 studies and semi-structured interviews with ten professionals, the preliminary research confirms a heavy reliance on informal knowledge sharing. It highlights the challenges of formalizing experiential insights.

This work-in-progress paper outlines the research motivation, questions, and methodology, followed by the design of the TacitFlow prototype, its conceptual architecture, and key interaction flows. It concludes with a discussion of planned contributions and ethical considerations.

CCS Concepts

• **Human-centered computing** → HCI design and evaluation methods; • **Applied computing** → Collaborative learning; • **Social and professional topics** → Computing and business.

Keywords

Tacit knowledge, Workplace learning, Onboarding and Offboarding, Voice-controlled systems, GraphRAG architecture, Graph-of-thought reasoning, Design-based research

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1 Introduction

Public sector institutions in high-stress operational contexts, such as corrections and internal security, face ongoing challenges in managing organizational knowledge [Song et al.(2023)]. These challenges become especially difficult during periods of workforce transition or by demographic changes [Donald(2021), Unt et al.(2020)]. When experienced personnel depart, they take with them an invaluable yet often easily lost resource: tacit knowledge, embedded in personal experience, informal routines, and intuitive practices [Leonard and Sensiper(1998), Boh(2007)].

Tacit knowledge is the key to institutional resilience, but it isn't easy to articulate, document, or standardize [Polanyi(2009)]. Its context-dependent nature often makes it invisible to formal knowledge management systems. As a result, knowledge transfer in organizations usually relies on informal and unstructured practices, such as spontaneous (ad hoc) mentoring or casual peer-to-peer storytelling [Nonaka(1998), Eraut(2004), Correa et al.(2022)].

Although valuable, these methods are challenging to scale and can easily break down when key people leave or routines change. This reliance on informal methods reveals a critical gap in systematic, technologically supported approaches to transferring tacit knowledge during these crucial periods.

In response to this challenge, this ongoing doctoral research project examines how public institutions can systematically support the capture and transfer of tacit knowledge during onboarding and offboarding processes in high-stress environments. The research began with a scoping review, followed by semi-structured interviews. A technological prototype has been developed based on these findings; the details of this prototype are included in a poster paper titled "Investigating Tacit Knowledge Transfer in Public Sector Workplaces," which is also included in the ECCE 2025 proceedings. The following steps will involve piloting and evaluation in collaboration with institutional partners, alongside efforts to develop or refine a conceptual framework for capturing and transferring tacit knowledge in high-stress public settings.

2 Research Problem, Objectives and Questions

This doctoral research addresses a critical challenge in high-stress public sector environments: how to effectively capture and transfer tacit knowledge during key workforce transitions, such as onboarding and offboarding. Tacit knowledge - unspoken, rooted in experience, intuition, and practice - is challenging to articulate and often escapes formal documentation [Leonard and Sensiper(1998), Polanyi(2009)]. These transitions risk organizational knowledge loss and undermine resilience, particularly when knowledge-sharing mechanisms are informal or ad hoc [Donald(2021), Unt et al.(2020)].

The study examines how voice-controlled auditory learning systems can support informal, situated knowledge exchange. It seeks to bridge theoretical understanding with applied design, integrating intelligent systems into the flow of workplace learning [Eraut(2004), Nonaka(1998)].

2.1 Research Objectives

- (1) Identify and analyze current practices and challenges in tacit knowledge sharing during onboarding and offboarding in public sector organizations.
- (2) Propose a theoretical and practical framework for capturing and transferring tacit knowledge.
- (3) Examine how voice-controlled auditory interfaces can support informal, situated learning based on the proposed framework.
- (4) Investigate the application of enhanced GraphRAG-based and graph-of-thought-based architectures to enable personalized, context-aware knowledge delivery.

2.2 Research Questions

- (1) What are the key challenges in capturing and transferring tacit knowledge during onboarding and offboarding in high-stress public sector environments?
- (2) How can technologies be designed to support the capture and transfer of tacit knowledge during onboarding and offboarding in high-stress public institutions?

3 Theoretical Foundations

This study builds on the foundational theories of tacit knowledge, beginning with Polanyi's [Polanyi(2009)] view that such knowledge is deeply personal, experience-based, and often difficult to express formally. The SECI model of Nonaka and Takeuchi [Nonaka(1998)] provides a widely used framework that explains how knowledge transitions between tacit and explicit forms through the processes of socialization, externalization, combination, and internalization. These dynamics are especially relevant during workforce transitions, such as onboarding and offboarding, where a significant amount of knowledge exchange occurs in informal settings.

Leonard and Sensiper [Leonard and Sensiper(1998)] emphasize that effective knowledge sharing relies on social interaction, trust, and shared context rather than documentation alone. Eraut [Eraut(2004)] highlights that most workplace learning in complex environments occurs through informal means such as observation, peer interaction, and learning by doing. Cabrera et al. [Cabrera and Cabrera(2005)] add that knowledge sharing is shaped by motivation, trust, and the broader organizational culture.

Recent literature continues to recognize these factors, highlighting an underdeveloped role for digital technologies in supporting the transfer of tacit knowledge. Reviews by Cho et al. [Cho et al.(2020)], Correa et al. [Correa et al.(2022)], and Song et al. [Song et al.(2023)] note that while traditional methods such as mentoring and job shadowing remain standard, intelligent systems that support context-aware, informal learning are still rarely used. This gap between practice and technological potential underscores the need for systems that can more effectively support informal and experiential learning, particularly during workplace transitions. This

research addresses the gap by exploring how voice-interactive tools can align with the way tacit knowledge is shared in real-world work environments, integrating theory with applied design. The aim is to create a technological solution that aligns with the relational and situated nature of tacit knowledge, while using voice-based technologies to support knowledge continuity during transitions in high-stress institutional environments.

4 Research Methodology & Preliminary Findings

To address the challenge of capturing and transferring tacit knowledge in high-stress public institutions, this research follows a Design-Based Research (DBR) approach. This methodology supports both theoretical exploration and the practical development of solutions in real-world contexts [Reeves and McKenney(2012)]. It unfolds in three phases that build on each other.

The **Phase 1: Analysis and Exploration** focused on understanding the problem domain through a systematic scoping review and semi-structured interviews.

The systematic scoping review was conducted to understand how tacit knowledge is captured, shared, and supported in organizational settings. It was carried out following Arksey and O'Malley's [Arksey and O'Malley(2005)] framework and guided by the PRISMA-ScR checklist [Tricco et al.(2018)]. The review covered 55 peer-reviewed studies and monographs, with a focus on knowledge continuity during onboarding and offboarding in complex institutional settings.

Databases searched included Scopus, Web of Science, and Google Scholar, using combinations of keywords such as "tacit knowledge", "onboarding", "offboarding", "informal learning", and "public sector".

Sources were excluded if they focused only on formal training programs, traditional knowledge management systems, or general workplace learning without specific attention to tacit, or experience-based knowledge. The aim was to focus on materials that explore how unspoken, embedded knowledge is used in real work settings.

The review identified five common barriers to tacit knowledge sharing (Figure 1):

- (1) lack of trust or a closed culture,
- (2) limited time and staffing resources,
- (3) difficulty formalizing unspoken knowledge,
- (4) technological limitations or underuse,
- (5) lack of benefits, rewards, or recognition.

The review also identified three key enablers and three key facilitators (Figure 2):

Key Enablers

- (1) *Supportive Leadership* when leaders set the tone for openness, model knowledge sharing, and allocate time and resources
- (2) *Trust and Psychological Safety* when people feel safe, they are more likely to share what they know without fear of judgment,
- (3) *Organizational Culture of Sharing* is a work environment where informal learning, peer interaction, and knowledge exchange are valued and expected.

Key Facilitators

Key Barriers to Tacit Knowledge Sharing



Figure 1: Key Barriers to Tacit Knowledge Sharing

Key Enablers and Facilitators of Tacit Knowledge Sharing



Figure 2: Key Enablers and Facilitators of Tacit Knowledge Sharing

- (1) *One-on-One Mentoring and Shadowing* when personalized knowledge transfer in real work settings supports deep, experience-based learning.
- (2) *Flexible and Informal Sharing Channels* when knowledge flows through informal discussions, voice notes, or shared reflections, not just formal documents.
- (3) *Recognition and Motivation* when simple forms of appreciation or gamification help to encourage consistent contributions.

These findings were grouped and visualized into two categories, "barriers" and "enablers", and informed the design of the interviews, which were also a part of the current phase. The interviews were semi-structured, including prepared questions while allowing for open conversation. The interviews were held with ten professionals from six Estonian public sector organizations, including the Police and Border Guard Board, the Estonian Academy of Security Sciences, the Information System Authority (RIA), Information Technology and Development Center of the Ministry of the Interior (SMIT), the Ministry of Defense, and the Defense Resources Agency (KRA). These organizations were selected as they represent high-stress public sector environments. The chosen participants included managers and specialists who were directly involved in training, onboarding, information systems, internal security, and defense-related services. This ensured that the interviews captured

a broad yet relevant perspective on how unspoken, experience-based knowledge is currently shared, lost, or retained in practice. Including institutions such as the Estonian Academy of Security Sciences, which is responsible for training future personnel in corrections and emergency services, provided insights into both the formal learning structures and informal mentoring practices used across the sector.

The interview questions explored the participants' lived experiences with onboarding and offboarding, informal knowledge-sharing practices, organizational culture, and their perceptions of the role of digital tools in these processes. Thematic analysis was conducted using Braun and Clarke's [Braun and Clarke(2006)] six-phase approach. Coding was carried out in Atlas.ti, applying a hybrid strategy that combined deductive codes (e.g., onboarding, documentation, digital tools) with inductive codes that emerged from the data (e.g., physical isolation, informal networks). This approach enabled the identification of detailed patterns in the way knowledge is shared, retained, or lost.

The interviews identified six key factors that support tacit knowledge transfer (Figure 3): fostering a psychologically safe culture, establishing formalized mentorship, designing office spaces for informal interactions, developing flexible documentation systems, utilizing structured one-on-one meetings, and implementing standardized offboarding procedures. In addition to these, learning by doing emerged as a common way to learn during onboarding and offboarding, especially in urgent situations. It was supported by most of the factors shown in Figure 3.

These six findings suggest corrective actions:

- (1) Foster a psychologically safe knowledge-sharing culture through managerial encouragement, open dialogue, and recognition of shared expertise.
- (2) Establish formalized mentorship programs that provide consistent and systematic onboarding support.
- (3) Design office spaces to encourage informal interactions and reduce physical isolation, especially for roles that involve oversight or auditing.
- (4) Develop structured yet flexible digital documentation systems that cater to diverse learning preferences (e.g., visual, narrative, discussion-based).
- (5) Use structured one-on-one meetings to document tacit knowledge while respecting confidentiality.
- (6) Implement standardized offboarding processes, including mandatory documentation and handover meetings, to retain operational continuity.

These themes, along with the outcomes from the scoping review, guided the design of the TacitFlow prototype's features. Although the scoping review and the interviews analysis are still in their concluding stages, both already provide a strong foundation for aligning system features with workplace realities and support the development of a preliminary base for capturing and transferring a tacit knowledge practical framework.

The study has advanced through the completion of a scoping review and the first phase of qualitative data collection and analysis, and is currently in **Phase 2: Design and Development**. Based on earlier findings, this phase focuses on turning insights from Phase 1 into a working solution - the first version of the TacitFlow

Facilitating Tacit Knowledge Transfer

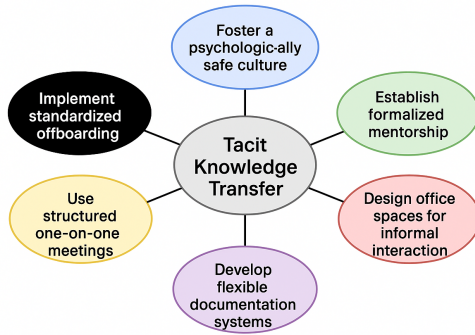


Figure 3: The Six Facilitators of Tacit Knowledge Transfer

prototype. The goal is to design and build a system that can help test theoretical assumptions about supporting informal learning in real situations. The prototype is designed for mobile and portable devices and already includes training materials provided by the Estonian Academy of Security Sciences.

At **Phase 3: Evaluation and Reflection**, the research will culminate with empirical testing. The prototype will be evaluated in real-world institutional settings to assess its usability, user engagement, and potential impact on knowledge retention. These findings will then be used to refine the tool and to propose a new or improve an existing theoretical framework.

5 Discussion and Future Work

This research offers the potential for significant contributions to the fields of Human-Computer Interaction (HCI), knowledge management, and workplace learning. The following sections reflect on the expected contributions, outline the project's limitations and ethical considerations, and present the next steps in this ongoing doctoral research.

5.1 Implications and Expected Contributions

The research confirms a heavy reliance on informal knowledge sharing in high-stress public institutions, highlighting the challenges of formalizing experiential insights. This ongoing work aims to bridge theoretical understanding with applied design, integrating intelligent systems into the flow of workplace learning [Nonaka(1998), Eraut(2004)].

This research contributes to the academic discourse in three main areas:

Theoretical development The study seeks to propose a framework for capturing and transferring tacit knowledge during onboarding and offboarding in high-stress institutional settings. This framework will be grounded in established theories, such as Nonaka's SECI model [Nonaka(1998)], Polanyi's concept of the tacit dimension [Polanyi(2009)], and Eraut's work on informal learning [Eraut(2004)], while incorporating findings from contemporary public sector contexts.

Empirical grounding Grounded in a scoping review of 55 studies and semi-structured interviews with ten professionals from Estonian public institutions, the findings provide a robust foundation for understanding current challenges and opportunities in tacit knowledge transfer [Correa et al.(2022), Cabrera and Cabrera(2005)].

Methodological contribution This study demonstrates the application of the DBR approach to studying tacit knowledge in complex, real-world settings. The phased structure, which combines literature review, interviews, and the development of a prototype, can inform similar research in workplace learning and HCI. DBR is especially useful when addressing problems that are closely tied to practice and shaped by local context, such as informal knowledge sharing [Reeves and Shipman(1996)].

In the context of this study, the approach enabled the exploration of how voice-supported tools could help capture and transfer tacit knowledge, while also refining the research questions based on real needs. Similar to the way Nonaka and Takeuchi describe the continuous interaction between theory and practice in the SECI model [Nonaka(1998)], DBR allows researchers to shift between understanding, designing, and testing. This process also reflects Eraut's view that most workplace learning is informal and situated [Eraut(2004)]. By combining reflection with practical development, this research provides a structure that can be used in other studies focused on learning at work, especially in settings where knowledge is difficult to formalize or standardize.

5.2 Limitations and Ethical Considerations

Tacit knowledge is deeply embedded in personal experience, intuition, and informal practices, making it difficult to capture, document, or standardize [Polanyi(2009), Leonard and Sensiper(1998)]. One key challenge in this research is translating rich, qualitative insights into structured components that can inform the development of a theoretical framework.

While interviews offer valuable perspectives, the limited sample size and diversity of organizational roles constrain the generalizability of the findings. Broader empirical validation across public sector domains will be essential for refining the framework and evaluating the system's transferability [Cabrera and Cabrera(2005), Correa et al.(2022)].

Additionally, ethical concerns arise when working in sensitive institutional contexts. Tacit knowledge in these environments may involve undocumented procedures or informal routines that are not easily shared without risking privacy, security, or interpersonal trust. Any technological system must uphold principles of transparency, consent, and user agency [Cho et al.(2020)].

5.3 Next Steps and Future Research

The third phase of this research's DBR cycle will focus on empirical evaluation in collaboration with institutional partners, including the Estonian Academy of Security Sciences. Planned activities include usability testing, participatory workshops, and small-scale trials and explore what possibilities are enabled by the proposed tool

to make voice-controlled audio-based learning more active and engaging.

In parallel with the empirical evaluation, the project aims to develop or refine a practical framework for capturing and transferring tacit knowledge. This framework will build on insights from the scoping review, interview data, and early usage patterns. The goal is to connect existing theories of tacit knowledge with real-world practices in informal, technology-supported workplace learning [Eraut(2004), Correa et al.(2022)].

This work aims to help design future smart systems that support human knowledge sharing, especially in stressful and important work situations.

6 Feedback

To support continued development and ensure the relevance of this research, the authors welcome feedback on the following points:

- (1) What new theoretical insights, practices, and reusable learning approaches can DBR facilitate in the context explored in this study?
- (2) Do the research methods, particularly the scoping review and interviews, adequately capture the realities of onboarding and offboarding in these environments?
- (3) Are there important learning practices or knowledge-sharing mechanisms that appear to be missing or underexplored in the current approach?

7 Conclusion

This paper presents the current stage of a design-based research study focused on capturing and transferring tacit knowledge in high-stress public institutions. Drawing on a scoping review and interviews with professionals from six Estonian organizations, the research highlights the practical and organizational challenges that arise during onboarding and offboarding.

The next steps in this research will build on these findings, aiming to explore how informal learning practices and real-world knowledge sharing can be supported through technology. Based on this, the study will propose or refine a practical framework that connects established theories of tacit knowledge with everyday practices in public sector settings.

The authors welcome feedback that can strengthen both the methodological and conceptual direction of the work, especially as it moves toward piloting in real environments.

8 Acknowledgment of AI Use

The author acknowledges the use of AI tools, including Grammarly and Overleaf's rephrasing features, to improve the language and clarity of the paper. Google Gemini was used selectively to assist in sentence-level refinement and fluency. The paper fully reflects the author's original research, structure, and intellectual contributions; no content was generated by AI tools.

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Author contributions: Iren Irbe: investigation, data curation, prototype design, writing – original draft, writing – review and editing. Abiodun Afolayan Ogunyemi: conceptualization of the research.

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