ASCILITE 2026

The Future is Connection:

Collaboration, Creativity and Compassion in a Digital Society

Towards human-centred agentic AI mentoring ecosystems for female cybersecurity students

Mary George, Leanne Ngo, Jabed Chowdhury

La Trobe University

Women remain underrepresented in cybersecurity higher education and the workforce, with participation and retention influenced by confidence, belonging, professional identity, mentoring, and career readiness. While Generative Artificial Intelligence (GenAI) is increasingly supporting technical learning in cybersecurity, its potential to enhance students' broader development remains underexplored. This conceptual position paper proposes a Human + Agentic AI mentoring ecosystem in which Agentic AI mentors complement, rather than replace, human mentors, educators, peers, and professional communities. Integrating Social Cognitive Career Theory (SCCT), women in cybersecurity literature, and human-centred AI design, we present a conceptual framework and design implications for Agentic AI mentoring that supports confidence, belonging, professional identity, career readiness and workforce transition. The framework extends AI beyond technical tutoring towards human-centred, co-designed mentoring across academic, social, and professional dimensions.

Keywords: Agentic AI, higher education, career readiness, human-centred AI, women in cybersecurity

Introduction

Despite growing global demand for cybersecurity professionals, women remain significantly underrepresented in both cybersecurity higher education and the workforce, comprising approximately 17% of the Australian and 20–25% of the international cybersecurity workforce (ISC2, 2024; Risse et al., 2023). Increasing women's participation and retention is important for workforce capacity and diversity (Bongiovanni & Gale, 2023; Risse et al., 2023). Challenges beyond recruitment include gender stereotypes, a narrow masculine image of cybersecurity, unequal access to role models and networks, isolation and low belonging, doubts about competence, biased recruitment and workplace cultures, and uncertainty during study-to-work transition (Bongiovanni & Gale, 2023; Giboney et al., 2023; Risse et al., 2023; Selman-Housein & Plancher, 2025; von Briesen et al., 2024). Support therefore requires more than technical skill development: mentoring, role models, networks, co-curricular engagement and career preparation can strengthen confidence, belonging and workforce transition.

GenAI is increasingly used in cybersecurity education for tutoring, curriculum support and cyber ranges, but its role in students' broader educational, social and professional development remains underexplored. Reviewed systems are largely chatbots, tutoring tools or retrieval-augmented generation applications; personalised dialogue alone does not make them agentic (Casheekar et al., 2024; Chang et al., 2023; Wang et al., 2025; Yusuf et al., 2025; Zhao et al., 2025). Our proposed mentoring ecosystem is conceptualised as agentic through capabilities including goal-directed planning, memory and tool use, adaptation over time, proactive recommendations, and coordination across human and institutional resources. Social Cognitive Career Theory (SCCT) provides a theoretical lens through self-efficacy, outcome expectations and environmental supports (Lent et al., 1994). Therefore, this paper explores how such an ecosystem may support female cybersecurity students through higher education and workforce transition while complementing human mentors, educators, peers, and professional communities.

RQ1. How can Human + Agentic AI mentoring ecosystems be designed to support female cybersecurity students' confidence, belonging, professional identity, career readiness, and workforce transition?
RQ2. What human-centred design principles should guide the development of Agentic AI mentors that complement, rather than replace, human mentoring?

To address these questions, we conducted a targeted narrative review spanning women in cybersecurity, SCCT, AI applications in cybersecurity and higher education, educational chatbots and human-centred AI

design. ACM Digital Library, IEEE Xplore and Google Scholar were searched, supplemented by targeted Google searches for government and industry reports. Sources were drawn primarily from 2014–2026, retaining earlier foundational theory. Representative searches combined "women" or "female" with "cybersecurity" or "cyber security" and terms including "confidence," "self-efficacy," "belonging" and "mentoring." Additional searches addressed identity, conversational agents, educational chatbots and human-centred design. Titles, abstracts and, where relevant, executive summaries were screened. Sources were retained when they informed barriers or supports, SCCT mechanisms, AI or mentoring functions, or human-centred safeguards. The findings were grouped across academic, social and professional dimensions, mapped to SCCT constructs, and translated into the proposed model and its design implications. This iterative review was targeted rather than systematic and is not intended to be exhaustive. This paper proposes a Human + Agentic AI mentoring framework and associated design implications that extend AI beyond technical tutoring to support confidence, belonging, professional identity and career readiness.

Opportunities for Human + Agentic AI mentoring ecosystems

Women's participation and progression in cybersecurity are shaped by interconnected educational, social and professional factors, including self-efficacy, confidence, belonging, mentoring, professional identity and the transition into the workforce (Bongiovanni & Gale, 2023; Giboney et al., 2023; Risse et al., 2023; Selman-Housein & Plancher, 2025). SCCT explains how learning experiences shape self-efficacy and outcome expectations, which then influence career interests, goals and choices. It also recognises that contextual supports and barriers can enable or constrain this process (Lent et al., 1994). For example, mentors and professional communities can provide support, whereas stereotypes, exclusionary cultures and limited professional networks can create barriers. SCCT therefore provides a theoretical basis for connecting the needs identified in the literature to purposeful mentoring functions.

Self-efficacy and confidence

Self-efficacy and confidence are recurring themes within cybersecurity and computing literature. Female students may experience uncertainty regarding their capabilities, particularly within traditionally male-dominated disciplines, which can influence engagement, persistence and perceptions of career readiness (Bongiovanni & Gale, 2023; Giboney et al., 2023). Existing GenAI applications in cybersecurity education demonstrate considerable potential to increase self-efficacy and confidence through personalised tutoring, cyber simulations, adaptive feedback and on-demand learning support (Wang et al., 2025; Zhao et al., 2025). However, evaluation remains focused largely on technical performance and short-term learning outcomes, with limited attention to self-efficacy, confidence or broader engagement among female cybersecurity students.

Belonging, mentoring and community engagement

Belonging, mentoring and engagement with professional communities are important influences on students' educational experiences and persistence in cybersecurity (Bongiovanni & Gale, 2023; von Briesen et al., 2024). Role models, mentoring and participation in co-curricular activities such as cybersecurity networks can strengthen confidence, motivation and connection to the cybersecurity profession (Bongiovanni & Gale, 2023). Current GenAI systems rarely connect users to mentoring opportunities, co-curricular activities or professional communities. Future GenAI cyber mentors could therefore act as bridges between students and broader educational, social and professional support networks.

Professional identity and career readiness

Professional identity development and career readiness are important components of students' transition into the cybersecurity workforce (Bongiovanni & Gale, 2023). Existing GenAI applications in cybersecurity have largely focused on technical learning and skill development, with less attention given to employability, workforce preparation or professional identity formation. A small number of studies propose career-oriented applications, but these approaches remain largely conceptual and have had limited evaluation (Koukou & Stavrou, 2024; Wang et al., 2025). This creates opportunities for future GenAI cyber mentors to support career

exploration, professional identity development, and workforce transition alongside cybersecurity learning. Together, the literature supports three interconnected domains for the model (Figure 1): self-efficacy and confidence; mentoring, belonging and community engagement; and professional identity development and career readiness.

Conceptual model for a Human + Agentic AI mentoring ecosystem

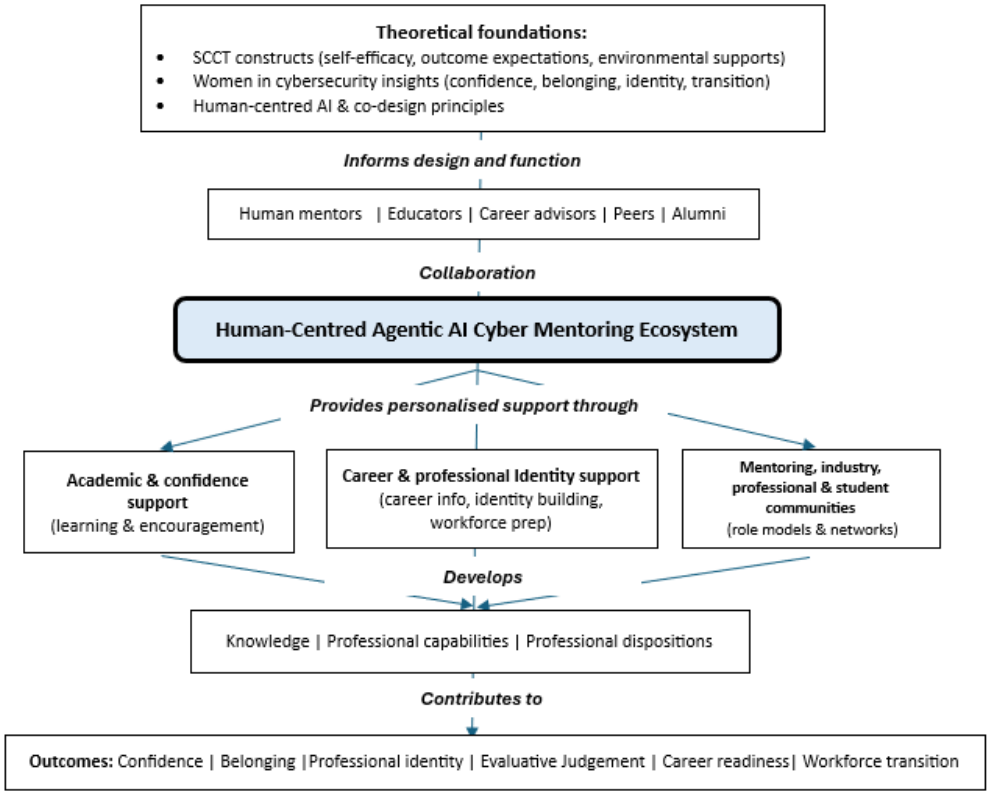


Figure 1. Human-centred agentic AI mentor within a Human + AI mentoring ecosystem

The conceptual development followed three stages: identifying educational, social and professional needs from the literature; interpreting these needs through SCCT constructs; and translating the resulting relationships, together with human-centred AI principles, into ecosystem components, stakeholder relationships and design implications. Building on the literature and informed by SCCT, we propose a conceptual model for a Human + Agentic AI mentoring ecosystem in which a human-centred Agentic AI mentor complements human mentors, educators, peers, and professional communities. Unlike existing chatbot and GenAI frameworks that primarily emphasise technical learning or generic career advice, the proposed model extends AI mentoring to support confidence, belonging, professional identity development, and workforce transition for female cybersecurity students. As shown in Figure 1, the model is informed by SCCT, women in cybersecurity literature, and human-centred AI design principles. The Agentic AI mentor collaborates with human mentors, educators, career advisors, peers, alumni, industry, and professional communities to provide personalised support across three interconnected domains: academic and confidence support, career and professional identity support, and mentoring and community engagement. Together, these domains contribute to knowledge, professional capabilities, and professional dispositions, leading to outcomes including confidence, belonging, professional identity, evaluative judgement, career readiness, and workforce transition.

In this paper, mentoring is understood as developmental support that fosters reflection, confidence, professional identity, career development and connection to professional communities over time. Within the proposed ecosystem, the Agentic AI mentor complements human mentoring by supporting reflective dialogue, personalised guidance, student-agreed goals, and connections to authentic learning, human mentors, and professional opportunities. This extends beyond tutoring focused primarily on knowledge or task performance, coaching towards a defined goal, and advising that provides procedural or option-based information.

Importantly, the Agentic AI mentor is not intended to replace the relational, experiential and contextual support provided by human mentors. As an initial conceptual model derived from the literature, the ecosystem provides a foundation for future co-design and evaluation with female cybersecurity students.

Design implications for human + Agentic AI mentoring ecosystems

Building on the conceptual model and addressing RQ2, we identify three design implications for Human + Agentic AI mentoring ecosystems: educational purpose and support, conversational design, and human-centred development and co-design. Educational purpose connects the identified needs to SCCT mechanisms; conversational design specifies how the AI should support reflection and relationships; and human-centred development defines co-design, oversight and responsibility boundaries. Rather than functioning solely as tutoring systems, Agentic AI mentors should complement human mentoring while addressing transparency, privacy, bias, and appropriate human oversight.

Educational purpose and support

Educational AI should be designed around clear pedagogical and career development objectives rather than information retrieval alone. While existing educational chatbots emphasise learning support, personalised feedback, and self-regulated learning (Chang et al., 2023; Yusuf et al., 2025), future Agentic AI mentors should also support confidence, career readiness, professional identity, and engagement with professional communities.

Conversational design

How Agentic AI mentors communicate is as important as the support they provide. Conversations should prioritise asking before advising, encourage reflection, adopt supportive mentoring language, and connect students with appropriate human mentors and professional communities. Future work should explore these communication preferences through co-design with female cybersecurity students (Casheekar et al., 2024; Majgaard & Andersen, 2025).

Human-centred development and co-design

Consistent with human-centred AI principles, agentic AI mentors should be developed through iterative co-design, prototyping and evaluation with women studying cybersecurity (Alfredo et al., 2024; Hu & Chan, 2025). Responsibility should be distributed across the AI, students and human stakeholders rather than transferred to the AI. The AI could personalise resources, track student-agreed goals, identify relevant opportunities and suggest referrals. Human mentors and educators should handle sensitive disclosures and assessment, while institutions retain responsibility for oversight, governance and escalation. Students should retain control over career decisions, consent, stored memory and data use, with access to human support when needed. These boundaries are proposals for validation through co-design; they do not suggest that the current prototype already implements a complete agentic mentoring ecosystem.

Conclusion and future implications

This conceptual position paper proposes a Human + Agentic AI mentoring ecosystem that extends beyond tutoring while keeping human relationships central. Integrating SCCT, women in cybersecurity literature and human-centred AI design, the framework links three support domains to confidence, belonging, professional identity and career readiness. The proposed ecosystem conceptualises Agentic AI as complementing human support through adaptive, goal-directed and proactive mentoring functions, rather than simply providing conversational or information-retrieval support. Future work will involve co-designing and evaluating a Human + AI mentoring prototype with female cybersecurity students. An initial Custom GPT is a starting point, not evidence that the full agentic ecosystem has been implemented or evaluated. Because this paper synthesises published literature and contains no participant data, formal ethics approval was not required; approvals HEC25518 and HEC25424 cover planned co-design and evaluation. The framework may also inform mentoring for other underrepresented groups in technology disciplines.

References

Alfredo, R., Echeverria, V., Jin, Y., Yan, L., Swiecki, Z., Gašević, D., & Martinez-Maldonado, R. (2024). Human-centred learning analytics and AI in education: A systematic literature review. *Computers and Education: Artificial Intelligence, 6,* Article 100215. https://doi.org/10.1016/j.caeai.2024.100215

Bongiovanni, I., & Gale, M. (2023). *Women in cyber: Exploring the barriers, redesigning the profession.* The University of Queensland. https://business.uq.edu.au/files/97978/women-in-cyber-exploring-the-barriers-report.pdf

Casheekar, A., Lahiri, A., Rath, K., Prabhakar, K. S., & Srinivasan, K. (2024). A contemporary review on chatbots, AI-powered virtual conversational agents, ChatGPT: Applications, open challenges and future research directions. *Computer Science Review, 52*, Article 100632. https://doi.org/10.1016/j.cosrev.2024.100632

Chang, D. H., Lin, M. P.-C., Hajian, S., & Wang, Q. Q. (2023). Educational design principles of using AI chatbot that supports self-regulated learning in education: Goal setting, feedback, and personalization. *Sustainability, 15*(17), Article 12921. https://doi.org/10.3390/su151712921

Giboney, J. S., Anderson, B. B., Wright, G. A., Oh, S., Taylor, Q., Warren, M., & Johnson, K. (2023). Barriers to a cybersecurity career: Analysis across career stage and gender. *Computers & Security, 132*, Article 103316. https://doi.org/10.1016/j.cose.2023.103316

Hu, W., & Chan, C. K. Y. (2025). From user needs to AI solutions: A human-centered design approach for AI-powered virtual teamwork competency training. *International Journal of Educational Technology in Higher Education, 22*(1), Article 52. https://doi.org/10.1186/s41239-025-00551-z

ISC2. (2024, April 25). *Women in cybersecurity: Inclusion, advancement and pay equity are keys to attracting and retaining more women*. https://www.isc2.org/Insights/2024/04/Women-in-Cybersecurity-Report-Inclusion-Advancement-Pay-Equity

Koukou, C., & Stavrou, E. (2024). The potential of generative AI chatbots as career advisors in cybersecurity: Professionals' perspectives. In L. Drevin, W. S. Leung, & S. von Solms (Eds.), *Information security education—Challenges in the digital age: 16th IFIP WG 11.8 World conference on information security education, WISE 2024, Edinburgh, UK, June 12–14, 2024, proceedings* (pp. 191–206). Springer. https://doi.org/10.1007/978-3-031-62918-1_13

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior, 45*(1), 79–122. https://doi.org/10.1006/jvbe.1994.1027

Majgaard, G. B., & Andersen, M. S. (2025). From code to character: Investigating personality in generative AI-driven educational avatars. In H. D. I. Sigurdardottir and R. I. Munkvold (Eds.), *The proceedings of the 19th European conference on games based learning* (pp. 543–551). Academic Conferences and Publishing International. https://doi.org/10.34190/ecgbl.19.2.4002

Risse, L., Beamond, M., Hall, J., Wang, L., Warren, M., Barua, B., & Kondylas, L. (2023). *Gender dimensions of the Australian cyber security sector.* RMIT University. https://www.rmit.edu.au/news/ccsri/understanding-gender-dimensions-project-study

Selman-Housein, E., & Plancher, B. (2025). Improving the representation of undergraduate women in cybersecurity: A literature review. In *Proceedings of the 56th ACM technical symposium on computer science education V. 1* (pp. 1043–1049). Association for Computing Machinery. https://doi.org/10.1145/3641554.3701811

von Briesen, E., Duvall, S., Mattfeld, R., & Spurlock, S. (2024). Mind the gap: Exploring differences in student perceptions of belonging and inclusion in computer science. *Journal of Computing Sciences in Colleges, 40*(5), 106–116. https://doi.org/10.5555/3717781.3717796

Wang, T., Zhou, N., & Chen, Z. (2025). CyberMentor: AI powered learning tool platform to address diverse student needs in cybersecurity education [Preprint]. *arXiv*. https://doi.org/10.48550/arXiv.2501.09709

Yusuf, H., Money, A., & Daylamani-Zad, D. (2025). Pedagogical AI conversational agents in higher education: A conceptual framework and survey of the state of the art. *Educational Technology Research and Development, 73*(2), 815–874. https://doi.org/10.1007/s11423-025-10447-4

Zhao, C., De Maria, R., Kumarage, T., Chaudhary, K. S., Agrawal, G., Li, Y., Park, J., Chen, Y.-C., Deng, Y., & Liu, H. (2025). CyberBOT: Ontology-grounded retrieval augmented generation for reliable cybersecurity education. In *Proceedings of the 34th ACM international conference on information and knowledge management* (pp. 6752–6756). Association for Computing Machinery. https://doi.org/10.1145/3746252.3761478

ASCILITE 2026

The Future is Connection:

Collaboration, Creativity and Compassion in a Digital Society

George, M., Ngo, L., & Chowdhury, J. (2026). Towards human-centred agentic AI mentoring ecosystems for female cybersecurity students. In Cochrane, T., Narayan, V., Poole, T., Lai, P., Lake, P., Moore, O., & Li, L. (Eds.), *The Future is Connection: Collaboration, Creativity and Compassion in a Digital Society*. Proceedings ASCILITE 2026. Brisbane (pp. 603–608). https://doi.org/10.65106/apubs.2026.3314

Note: All published papers are refereed, having undergone a double-blind peer-review process.
The author(s) assign a Creative Commons by attribution license enabling others to distribute, remix, tweak, and build upon their work, even commercially, as long as credit is given to the author(s) for the original creation.

© George, M., Ngo, L., & Chowdhury, J.2026