

Co-creation in action: Bridging the knowledge gap in artificial intelligence among innovation champions

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ABSTRACT

The increasing significance of artificial intelligence (AI) in various industries highlights the necessity for industry leaders and professionals to comprehend and gain knowledge about AI. The urgency for AI literacy is more critical than ever due to the potential unethical use of AI resulting from insufficient knowledge. This issue is particularly crucial for educators because they need to understand and adapt to the impact of AI within educational institutions, with some needing to use and become literate in AI, given that students now have increased access to public AI tools. This research presents a multi-phase study to address the issue of bridging the knowledge gap in AI by conducting co-creation with innovation champions, illustrated by a case of Generative AI innovation in a K-12 school. Using action design research, we engaged experienced teachers who are experts in pedagogical innovation to co-create a generative AI-enhanced platform at a leading K-12 education institution known for its pedagogical innovation in Australia. The findings reveal that champions enhance their knowledge through their subject-matter expertise, organizational knowledge, and AI knowledge gained through external exposure and experience. The study also highlights the key elements that facilitate a cross-domain knowledge exchange platform, enabling champions to be exposed to and experience AI technological learning, leading to shifts in their understanding and perception of AI. The initially unaware and sceptical champions become more aware and capable of articulating more technical AI knowledge rooted in a shared value. This research demonstrates how co-creation serves as a pathway for learning AI, particularly among K-12 teachers who are innovation champions. It underscores the impact of experiential and organizational learning on AI collaborative learning and behavioral intentions. Additionally, the study presents that aligning organizational and personal visions and values can influence perceptions about AI technologies, enhancing the discourse on AI and education innovation.

1. Introduction

Artificial intelligence (AI), which is the ability of computer systems to achieve tasks by mimicking complex human intelligence in processing and analyzing data, has become an indispensable asset for firms in maintaining their competitive advantage (Martin et al., 2024). This technology has enabled innovation to permeate beyond the computing industry and transform numerous industries, including business, education, and medicine (Ng et al., 2021). Since 2023, AI has been identified as 'the most impactful emerging technology' based on its level of adoption, and this trend is expected to continue for the next decade (Nguyen et al., 2022). The State of the CIO 2023 reports that 26% of information technology (IT) leaders say AI will drive the most industry

investment over the next decade (Stackpole, 2023). Understanding and gaining knowledge in AI has therefore become a critical agenda amongst industry leaders and professionals.

The need for AI literacy is more pressing than ever, in part because the risk of insufficient knowledge of AI may lead to its unethical use. Furthermore, the advancement of generative AI and its release for public use, through applications such as OpenAI's *ChatGPT*, has created a significant rise in the number of AI users and therefore an increased risk of knowing or unknowing, unethical use of AI (Haque & Li, 2024). An example of a high-profile AI incident from 2023 occurred when a lawyer jeopardised his career by submitting non-existent precedents in support of his client's case (Bohannon, 2023). This was because the lawyer used *ChatGPT* to find case examples, unaware of the possibility of false results

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being generated by the AI tool. According to the AI, Algorithmic, and Automation Incidents and Controversies database, the number of critical AI incidents and controversies due to uninformed use alone has increased by 185% in the last ten years (Maslej et al., 2023). This is not surprising due to its increased use and novelty, but such incidents and the overall industry trends do inform a need to promote awareness and understanding of the constraints of AI and its implications among professionals, especially in non-computing industries.

The lack of AI literacy is a major issue, particularly in the education industry. According to a survey conducted in 2023 among K-12 teachers in the United States, 96% of the respondents had yet to receive any professional development related to AI (Korhonen, 2024). However, there is a continued demand for teachers to adapt and understand AI's impact in K-12 schools because AI is permeating into the students' lives as well as the school organizational process overall (Bahrour et al., 2023). AI innovations in K-12 schools, including generative AI, provide capabilities that can be used to support personalized learning design, facilitate curriculum development, and enrich teaching practices (Zafari et al., 2022). Yet, these innovations are frequently framed by students' and school leaders' perspectives with few considerations of integrating the teacher's role as the teaching and classroom manager. Arguably, most digital technology that has been developed from IT and engineering perspectives is not aligned with teachers' expertise and experience yet, making it challenging for teachers to increase their digital literacy at this time, especially in AI (Chen et al., 2020). The need to bridge this knowledge and acceptance gap to increase teachers' understanding and perception about AI is critical at this time, because generative AI tools, such as *ChatGPT*, have become more accessible to the public – and students. Teachers must now understand the impact of AI on their role, as well as its impact on students who may misuse the AI tools, deliberately or otherwise, for example, through the use of plagiarism in assignments and quoting non-existent references generated by the AI tools (Westfall, 2023). The knowledge gap in AI is a problem that extends not just across the education sector, but numerous industries where non-computing professionals must understand and gain literacy about AI.

The presence of champions in AI innovation provides a crucial piece in bridging the knowledge gap in each industry. Global data shows that firms that have been successful in closing the knowledge gap are led by innovation champions who have an understanding of both their industry-specific expertise as well as AI scientific and engineering knowledge (Chakravorti et al., 2023). However, this success tends to be limited to technology-related firms, such as e-commerce giants like Amazon and Alibaba (Jelassi & Martínez-López, 2020). Firms not directly related to technology often face challenges in AI innovation as their champions struggle with comprehending AI technological capabilities and challenges, widening the knowledge gap (Girasa, 2020). This gap arises from discrepancies between the champions' industry-specific domain expertise and their comprehension of the AI technical opportunities and challenges, which impedes well-informed decision-making for successful innovation in their sphere of expertise (Birkstedt et al., 2023).

Moreover, in addition to providing technical leadership, research in digital innovation highlights the importance of having digital technology industry champions because they can be crucial intermediaries between upper management and frontline employees (Wilden et al., 2023). Although the knowledge gap has not been directly addressed in the previous works, going forward, co-creation in digital technology emerges as a potential platform for informed development (Loureiro et al., 2020). Co-creation enables more effective knowledge management for innovation in an industry, transforming employees from passive recipients of change to proactive contributors and drivers of innovation within their organizations. However, the involvement of champions and co-creation to bridge the knowledge gap in AI innovation is yet to be fully explored.

The primary focus of the research is to address the challenges in AI

innovation management, which is to bridge the knowledge gap among innovation champions regarding AI. This is an issue in the education sector, where there are conflicting opportunities and challenges related to AI capability, raising concerns about the future role of traditional creative knowledge workers, including teachers. This paper looks at the challenges facing emerging teachers' champions in AI to illustrate the example of barriers and enablers related to bridging the AI knowledge gap in the K-12 education innovation. This paper contributes to research on this issue by conducting co-creation with the champions to understand the barriers to bridging the knowledge gap and building the enablers to close it.

This paper aims to achieve three primary objectives: (1) to investigate the understanding and perception of innovation champions regarding AI and the barriers they face; (2) to identify the requirements for bridging knowledge about AI that is relevant to innovation champions; and (3) to examine the impact of co-creation on building knowledge and perception about AI among the champions.

The key contribution of this paper is demonstrating how co-creation acts as a conduit for learning AI, aiding professionals like innovation champions in understanding the technology better and bridging the knowledge gap. The focus on champions among the K-12 teachers provides a unique angle on AI enablers and barriers from the domain experts in teaching and learning who placed themselves as teachers and learners of AI in the study. It informs how experiential and organizational learning enhances collaborative learning and impacts behavioral intentions in AI technological learning among champions. The research also finds that aligning organizational and personal visions and values can influence the perception about AI technologies, adding depth to technological acceptance theories and introducing a new dimension to technological design theories. In summary, this paper enriches the discourse on AI and education innovation by highlighting the pivotal role of co-creation with innovation champions in deepening our theoretical understanding and enhancing practical applications in AI learning and innovation.

The paper is structured as follows: Section 2 presents the literature background on AI innovation in the context of education and the knowledge gap issue, suggesting the importance of champions and co-creation. This review leads to more specific research sub-questions to address the literature gap. Section 3 describes the methodology adopted in this study. Section 4 specifies the findings related to the initial understanding and perception of the champions about AI, key elements that facilitate bridging the knowledge gap, and changes identified after co-creating the champions' understanding and perception of AI. Section 5 discusses the findings' implications from a general lens, comparing them with existing works to address the research question. Finally, Section 6 concludes the paper and specifies the theoretical contributions, limitations, future research, and practical implications.

2. Literature review

2.1. Artificial intelligence innovation in education

Innovation is critical for organizations as the centre for economic growth and sustaining competitive advantages (Damanpour & Daniel Wischnevsky, 2006). Innovation is defined as a successful idea in exploring new or exploiting existing products or services, processes, and technology, shaping an organization's capability (Adams et al., 2006; Slappendel, 1996). Existing research emphasizes the critical role of innovation in maintaining an organization's competitive advantage, especially as firms work to adapt and enhance their business value in the face of global competition, rapid technological advancements, and limited resources (Damanpour & Daniel Wischnevsky, 2006; Nambisan et al., 2017).

Digital innovation, especially those including AI, is essential for organizations to gain a competitive advantage by enhancing their operational capabilities through large-scale data analytics and information

processing (Haefner et al., 2021; Kelly et al., 2021). AI is defined as “the science and engineering of making intelligent machines” (McCarthy, 2007). The rising scientific advancement in AI presents opportunities for organizations to identify emerging market trends, leverage their strengths, and innovate new products or services (Haefner et al., 2021; Mühlroth & Grottke, 2022). While these capabilities automate certain tasks, they also raise concerns about potential challenges to job security for employees.

The challenges stem from a lack of clear vision regarding the decision to innovate using AI among upper management and a lack of understanding in AI capabilities and benefits for employees individually (Chowdhury et al., 2023; Makarius et al., 2020). These issues are all tied to the knowledge gap between the intended purpose of AI innovation and the employees’ understanding of AI’s usefulness in their work (Davis et al., 1989; Makarius et al., 2020; Venkatesh et al., 2016). The literature on AI innovation suggests that effective knowledge management practices are essential for maximizing and sustaining the innovation (Castaneda & Cuellar, 2020; Mariani et al., 2023; Olan et al., 2022). The concerns related to knowledge and the role of knowledge management inform the need to enhance employees’ understanding of AI, particularly for those in key decision-making roles (Peykani et al., 2022).

Educational institutions face even more complex challenges in this regard. AI applications in education have evolved over the years, with increasing adoption across K-12 institutions (Zafari et al., 2022). Generative AI’s growing advancements herald a new era of pedagogical enhancement and instructional transformation, as it enables personalized learning experiences that tailor content and feedback to students’ unique needs and learning trajectories, significantly departing from the one-size-fits-all model of traditional educational paradigms (Bahroun et al., 2023; Ng et al., 2022). Innovation with Generative AI in K-12 education institutions presents an important case of identifying opportunities and challenges concerning advanced AI capabilities in generating content for teaching and learning, raising questions about the future role of teachers as traditional creative knowledge workers (Awidi, 2024; Chen et al., 2020). Due to its conflicting opportunities and challenges, educational institutions increasingly face challenges related to aversion towards AI adoption due to teachers’ knowledge gap related to misconceptions around AI, lack of confidence in using AI systems, and lack of understanding of AI’s purpose in education (T. Wang & Cheng, 2021).

2.2. Champions and Co-creation in the AI innovation

The knowledge gap in AI innovation revolves around the extent to which employees are willing to support AI innovation. This issue is more prevalent in the non-computing sectors due to concerns about job loss because of the common perception that AI automating human tasks can replace human employees’ roles (Kitsios & Kamariotou, 2021; Strich et al., 2021). Some employees resist using new AI-powered tools and processes because they prefer traditional methods, especially knowledge workers with many years of experience confident of their own crafted methods (Choi et al., 2023; Mirbabaei et al., 2022). Another barrier, particularly for organizations’ leaders is the significant investment cost to adopt AI and get employees on board (Y.-T. Chiu et al., 2021). It requires organizations to enhance their technological infrastructure, engage external technology service providers, and educate employees on new tools and processes. As a result, the AI innovation process more often, than not, unable to reach its full potential without getting employees on board.

As firms’ business models evolve, the role of champions in driving innovation has become increasingly crucial. Early innovation management literature suggest that the support and participation of champions in innovation initiatives are instrumental in fostering overall employees’ support (Drechsler et al., 2021; Larsen, 1993). These champions are tasked with translating strategic directives into actionable plans and

advocating for innovation (Heyden et al., 2020; Randhawa et al., 2021). Given the complexity and time-consuming nature of the collaboration process, champions serve as vital initiators of innovation in a collaboration project (Heyden et al., 2020). Their involvement has been shown to provide external collaborators with insights into the firm’s upper management and overall employee needs, leveraging their collective sensemaking and creative confidence through their experience in working with everyone across the firm for championing innovation (Randhawa et al., 2021).

In the AI for education literature, the role of key champions has also been suggested. There is a need to involve teachers in the AI development process to ensure that the AI application is not just technically advanced and generally helpful for students’ learning but also for teachers’ work as learning content creators and deliverers (Ahmad et al., 2021; Chen et al., 2020). Other works corroborate this approach, emphasizing the importance of understanding teachers’ contexts and attitudes toward AI to develop effective, teacher-friendly AI solutions (Chaipidech et al., 2022; Choi et al., 2023). The role of teachers emerges as a cornerstone for successful AI acceptance in education, as they are end-users of AI tools and are integral to their development, implementation, and evolution (Siemens et al., 2022). In addition, teachers who are champions of teaching innovation in their organization have also contributed to the success of digital innovation in K-12 education institutions (Patnaik & Gachago, 2020). Therefore, engaging teachers who champions innovation in K-12 education institutions is needed to understand the misconceptions and lack of understanding of AI, which impact the knowledge gap.

In a broader digital innovation literature, collaboration between champions and AI engineering teams to develop AI solutions, mainly through co-creation, enables organizations to leverage a range of expertise, foster innovation, and collectively address challenges (Barile et al., 2020; Wiljer et al., 2021). Involving key employees has been suggested as a critical strategy for bridging the knowledge gap in digital innovation (Peykani et al., 2022). Engaging in co-creation with technical teams aids in comprehending the organization’s propensity for innovation and knowledge-sharing and ultimately building trust and commitment among the champions towards AI integration (Loureiro et al., 2020). This approach is advocated as vital for sustaining AI innovation within organizations (Sjödin et al., 2021). The co-creation approach has been proven effective in an initial collaborative design project between digital innovation researchers and the creative design industry’s champions on identifying AI opportunities and challenges for improving the scalability of existing design operational processes and broadening the scope across traditional boundaries (Verganti et al., 2020). The collaboration enables interaction and knowledge exchange, thereby bridging the knowledge gap. The importance of champions in the process is increasingly apparent, yet their contribution to bridging the knowledge gap in AI innovation remains largely unexplored.

2.3. Research question

The research aims to understand how co-creation contributes to bridging the knowledge gap in AI through the following sub-questions: (1) What are the initial understanding and perception of AI held by innovation champions, and how have they formed these understandings? (2) What key elements can facilitate bridging the knowledge gap between those who champion innovation and AI through co-creation? (3) How has the co-creation process changed the perception and understanding of AI for the innovation champions?

3. Method

The study utilized action design research (ADR) to investigate the impact of co-creation on champions’ perception toward AI, both before and after the research (Sein et al., 2011). ADR utilizes theory and practical applications to address real-world issues relevant to

organizations. Furthermore, reflection learning in the ADR creates fresh perspectives and generates new insights and knowledge. ADR has been used to design and implement educational innovations related to complex information technological and system development (El Idrissi et al., 2023). This approach allowed for flexibility in design and processes to meet the needs of both researchers who had the role of AI engineers with a computing industry background and the study's participants as the champions from non-computing industry backgrounds (Ollila & Yström, 2020).

The research was conducted at a K-12 education institution known for its innovative teaching methods and extensive experience in research, development, and innovation over two decades. The focus was on developing a Generative AI tool to enhance the school's core innovation product—a lesson planning platform for teachers—in the emerging area of Generative AI innovation for teaching and learning (Bahroun et al., 2023; Tan, 2023).

The data was collected between April and August 2023 with a multi-phase engagement approach involving semi-structured interviews, a co-design workshop, and project documentation. The interviews covered a range of topics, including participants' backgrounds, innovation journeys related to the lesson planning platform, digital innovation backgrounds, understanding of AI, concerns, envisioned capabilities to

improve the platform, and the school's AI readiness, for a comprehensive understanding of the participant profile relevant to their education and innovation background. The workshop also included questions related to the AI components, such as understanding, concerns, envisioned capabilities, and the school's readiness, with a particular focus on observing changes of view on AI among participants. Appendices A and C include more details on the interview and workshop questions.

Due to the longitudinal approach of this research, we recruited the participants through purposive sampling based on specific criteria, in consultation with the school on the people involved in the lesson planning platform. Our participant inclusion criteria requires that the teachers must have a minimum of 20 years of teaching experience to ensure a deep understanding of teaching practices prior to the AI era, as well as active involvement in the ongoing innovation and integration of the teacher lesson planning platform, informed by previous works related to champions in K-12 schools (De Nobile, 2018; Reinius et al., 2022). Additionally, individuals were excluded if they were not part of the project during data collection or were involved in only specific stages, such as solely the interview phase. These criteria aimed to maintain uniformity in the data and interactions gathered from each participant across all stages of the study. The selected participants, four innovation champions, presented as A, B, C, and D, were teachers who

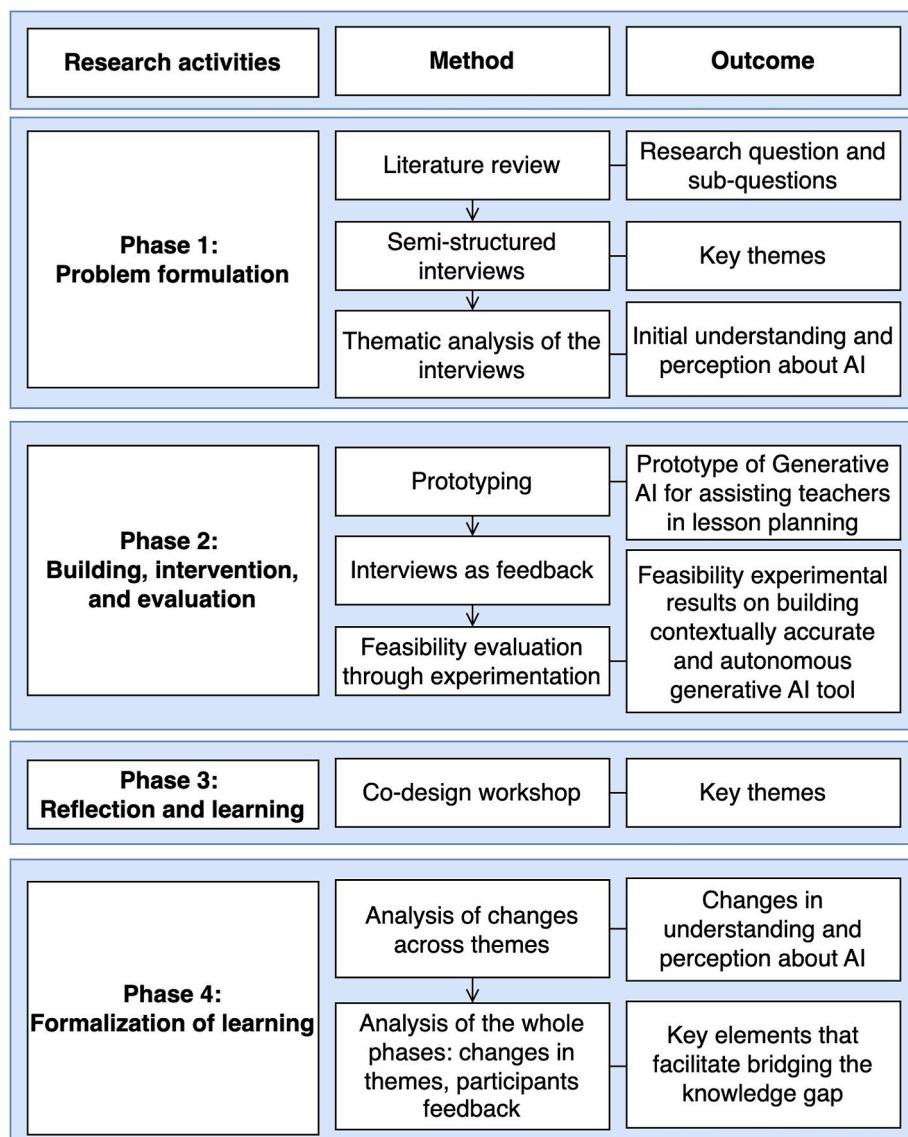


Fig. 1. Research activities, methods, and outcomes adapted from ADR (Sein et al., 2011).

were pedagogical coaches in the school and were instrumental in innovating and adopting the lesson planning platform from its inception to its digital format at the time of the data collection. They led the innovation and integration of new teaching methods through the lesson planning platform, bringing their varied roles, subject-matter expertise, and at least 20 years of experience as teachers.

The research activities were sequenced into four distinct phases adapting from ADR core phases, as illustrated in Fig. 1: (1) problem formulation, (2) building, intervention, and evaluation, (3) reflection and learning, and (4) formalization of learning.

Phase 1 of our research was driven by a practical, real-world problem in the school, a problem that resonated with the existing research works, i.e., generative AI for teachers. We conducted the interviews with the participants to identify their initial understanding and perception about AI. The key themes that emerged from the interview data were not just design considerations for the subsequent phase, but also crucial insights that could potentially address the practical problem at hand.

Phase 2 was where the building, intervention, and evaluation cycles were conducted. In this phase, the design considerations were used to build a prototype using ChatGPT, as it was the most familiar tool for the participants, to provide how generative AI can help align with their understanding and expectations. The participants' feedback on the prototype informed the need to look at the technical feasibility of bridging the participants' wishes from their needs as teachers and the technical resources and capabilities of generative AI technology. This feasibility experimentation aimed to inform the participants on the extent to which their wishes could be fulfilled and the time and resource requirements for future development and integration. This whole process encapsulates building, intervening and evaluating the generative AI with the participants while exchanging knowledge between the participants' expertise in education and the researcher's knowledge in AI technological design and development.

Phase 3 closed the process with reflection and learning through a co-design workshop. This allowed the participants to reflect on the whole Phase 2 journey and learn through collective discussion in the workshop about their understanding and perception of AI.

Phase 4 of our research was a culmination of the collaborative efforts of all participants. We meticulously analyzed the interviews and workshop data, including the participants' feedback and results from Phase 2, to identify key elements that facilitated changes in participants' knowledge about AI. This comprehensive analysis aimed to create knowledge about AI collaboratively, bridge the knowledge gap, and evaluate the cross-domain knowledge exchange between the participants' expertise as teachers and innovation champions and the researchers' knowledge in AI development.

4. Results

The data analysis results gathered from different phases have been arranged according to the research sub-questions. This section contains representative statements from the participants, while the complete

details can be found in Appendices B, C, and D.

4.1. Initial understanding and perception of AI

This section presents the findings gathered in Phase 1 regarding each participant's understanding and perception of AI, as detailed in Table 1.

The results reveal that participants' understanding of AI varied and was influenced by their subject-matter expertise, industry-specific (i.e., teaching) and innovation experience, and external exposure to AI. Their understandings come from different lenses of their subject-matter expertise and decades of experience in teaching and innovation, prompting them to be open-minded and consider AI from its opportunities and teaching principles. For instance, C's understanding of AI was shaped by their teaching background and their involvement in innovation, highlighting challenges with accessing archived planning documents, which were stored physically and time-consuming to locate for reference.

Representative quotes about their understanding are presented below.

A: "My understanding is that it can be a really powerful tool and that the strength and the capability of AI will depend on the scaling up of the existing planning platform."

B: "I think there is a real opportunity to make teachers' lives easier, but in doing it, not taking the thinking out of the teacher's heads, to still allow teachers to think about how this lesson sequence is going to play out."

C: "When I think of the potential for AI, I guess developing that efficiency and developing that bank of data that could be used to improve what we do in the classroom with children."

D: "I have used AI to develop some cards and teaching tools. So we have really transitioned and thought about how we use AI to create a particular image or some resources that we are creating, which has been cool."

On the other hand, the participants' experiences with AI tools and external exposure, such as from media and communities, varied, influencing their positive and negative perceptions toward AI. Interestingly, there is a clear correlation between the participants' perceptions and their experience and external exposure to AI. B and D had positive experiences with AI and had a positive outlook towards AI. In contrast, A and C, who had zero and negative experiences with AI, had neutral or negative perceptions about AI. Overall, this pattern was visible among the participants, with their sentiments and perceptions about AI being closely linked to their personal experiences with AI.

A had a neutral perception of AI with external exposure from media:

"I only know what I have read this year, in and around ChatGPT or just GPT in general, and what is happening with that."

At the moment, I would say I do not have any concerns around AI, but then I do not know what I do not know about it."

B, with their profound expertise and extensive experience in design

Table 1
Participants' characteristics related to their understanding and perception of AI.

Characteristics	A	B	C	D
Role in Organization	Pedagogical Coach and Team Leader	Pedagogical Coach	Pedagogical Coach	Pedagogical Coach
Understanding about AI	Powerful tool i.e., ChatGPT	An opportunity to make teachers' lives easier	A tool to build efficiency by storing large-scale data	A creative tools for visualizing ideas for classroom resources
Perception toward AI	Neutral	Positive	Negative	Positive
Factors influencing understanding and perception about AI	Creative learning and visual art	Design thinking	Interdisciplinary and transdisciplinary teaching	English and Humanities
Subject-matter expertise			More than 25 years	
Experience in teaching and innovation	More than 30 years	More than 25 years	More than 25 years	More than 20 years
Experience with AI tools	-	✓	✓	✓
External exposure	✓	✓	✓	✓

thinking and teacher collaboration, has developed a positive perception of AI. Their understanding of AI, influenced by media exposure, was primarily focused on ChatGPT, an AI tool that was prevalent in the media at that time.

"AI is an interesting one. I have always been interested in those sorts of technological things."

I sort of see but know, based on what I have read, heard, watched, and so on.

I think there is a real opportunity to make teachers' lives easier, but in doing it, not taking the thinking out of the teacher's heads, to still allow teachers to think about how this lesson sequence is going to play out."

C, having had a personal journey of scepticism due to negative experiences and exposure to AI, has developed a nuanced perception of AI technology.

"I am not necessarily a fan of using generative AI tools to assist in student-related reporting because, although AI is very clever, it does not capture the true essence of who the children are. That approach at this stage has yet to meet our needs."

D had a positive perception of AI and had a positive experience using AI tools and exposure from students.

"AI is really interesting."

So, my year sevens have loved using it, and I have encouraged other staff to use it as well."

4.2. Key elements that facilitate bridging the knowledge gap between champions and AI through Co-creation

The multi-phase nature of the research approach informed specific elements that facilitate bridging the knowledge gap with the participants. Fig. 2 illustrates the key elements that unite, progress, and enable changes in the participants' understanding and perception of AI. They consist of aligning individual values, organizational vision, as well as visual and technical bridges.

4.2.1. Alignment with individual values

Four themes emerged from the participants' answers in the initial interviews (Phase 1) and the co-design workshop (Phase 3) - envisioned AI values, capabilities, challenges, and strategies. The initial identification of these themes in Phase 1 revealed that all sub-themes were related to aligning AI values, capabilities, challenges, and strategies with the participants' individual values.

The initial sub-themes of 'AI values' and 'capabilities' described AI as an intelligent assistant that helps teachers grow, providing creative ideas and personalization based on exemplars and other teachers' knowledge. These sub-themes were shared among all participants. Here are some representative quotes from participants to provide context on their varied interpretations given their understanding and perception about AI:

4.2.1.1. Theme 1: initial AI values. Sub-theme 1: AI as an intelligent assistant.

A: "You can not ever take the human out of the role of teaching."

C: "In terms of data, developing more efficient systems to draw on what people are doing because people are doing fabulous things."

Sub-theme 2: AI to enable teachers' growth.

B: "Hopefully, this integration of AI technology will alleviate those challenges for people; I think that will enable them to access their planning and be able to have more fluency in what they do."

D: "I see it as being a stimulus. I see it as a starting point for many staff members. You know, let us actually see what is out there."

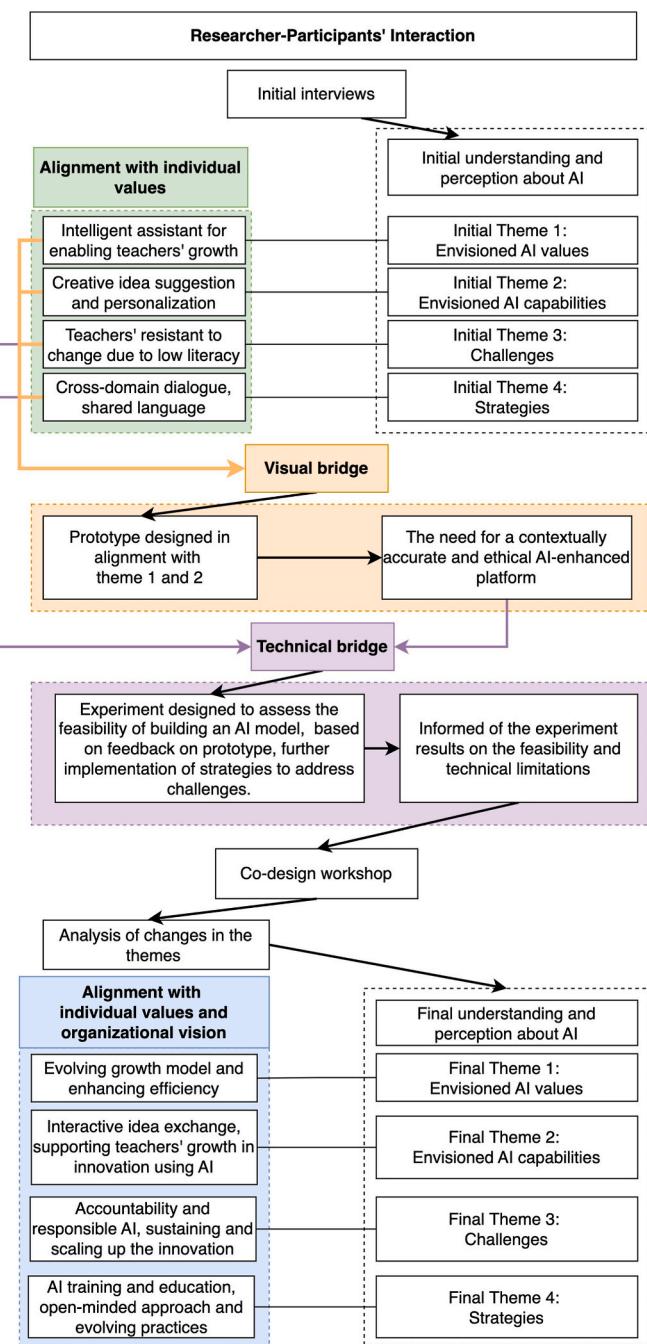


Fig. 2. Key elements that facilitate bridging the knowledge gap: Alignment with individual values and organizational vision, visual and technical bridges.

4.2.1.2. Theme 2: initial AI capabilities. Sub-theme 1: Creative idea suggestion.

A: "So if the platform provides intelligent assistance, such as prompts, I hope that it will give me ideas about what I should be doing?"

D: "It connects ideas that the system or the AI is reading 'you are planning' and goes, there are all these opportunities, and have you thought about this?"

Sub-theme 2: Personalization from exemplars and other teachers' knowledge.

B: "When I suggested collaborating with people in this room, or in Melbourne, or even in Rome, and sharing all these wild ideas, I meant that we should find out what works and then work together to support different areas, such as design in the classroom. Science teachers could collaborate in person and even across the world."

C: "It is about gathering data more efficiently to tap into the great things people are doing, which are currently spread out across different platforms like desktops and private files. I think the potential for AI lies in improving efficiency and creating a bank of data that can enhance classroom activities for children."

In Phase 1, two challenges surfaced: maintaining the quality and integrity of teaching and resistance to change. A and C, who held neutral and negative views about AI, emphasized teachers' critical role in ensuring the teaching model's quality and integrity. They were apprehensive about the prospect of AI automating everything and the potential loss of the human relational touch in teaching. In contrast, B and C, who had a positive outlook, viewed the challenge from a different angle: persuading teachers to embrace AI and innovate. They pointed out that teachers often resist changes, which could hinder AI adoption in teaching.

4.2.1.3. Theme 3: challenges. Sub-theme 1: Maintaining the quality and integrity of the teaching model.

A: "There just has to be academic integrity the whole way through because this is an academic environment."

C: "Although AI is very clever, it does not capture the true essence of who the children are."

Sub-theme 2: Teachers' resistant to change.

B: "A level of technological literacy teachers need to improve."

D: "What we have found with other changes is that initially, you will have staff who dive straight in, and the same goes for AI. You have got people over having a go, and you have people who resist that."

Based on their experiences as champions working with fellow teachers on digital innovation, they also identified strategies to tackle the challenges. These strategies addressed the issues and provided viable solutions to improve teachers' digital learning experience.

4.2.1.4. Theme 4: strategies. Sub-theme 1: Cross-domain dialogue for enhanced understanding.

C: "I think it is critical to truly conceptualize what we do for an outsider or somebody who does not work in the field."

Sub-theme 2: Prioritizing internal readiness and alignment with teachers' values.

A: "Rather than accept, reject, it is kind of like, go for it, let us have another look at something. It is a growth mindset because you are working and want to shift people and encourage them to move and change their behavior."

Sub-theme 3: Informed decision-making for overcoming doubts.

C: "I think it is really important for them to concretely see what we are trying to achieve. You can talk to somebody about what we do, but some people will have doubts. As a learner, I think it is really good to be able to show and experience what that is so they understand."

Sub-theme 4: Creating a shared language to encourage a growth mindset and trust-building.

A: "It is about building trust in the system. It is about building consistency. It is about building a common language and narrative."

It is evident from the various themes and sub-themes that there exists a strong connection between the alignment of all participants to their values as innovative teachers and their role as pedagogical coaches who inspire other teachers to innovate. This connection is apparent in the way they suggested challenges and practices based on their experiences of encouraging changes in teachers through their values and enabling their growth.

4.2.2. Visual bridge

The prototyping process exemplified the significance of the visual bridge, a critical element that bridged the gap between the participants' subject-matter expertise on how AI could assist teachers and the generative AI capabilities. The decision to build the prototype was based on the lessons learned from the participants' challenges and strategies,

such as C's emphasize on the importance of "concretely seeing" to demonstrate and allow others to experience and develop an understanding on AI technology.

The visual bridge served as a proof-of-concept for an intelligent assistant designed to help teachers plan their lessons. It was inspired by the principles of human-AI collaborative intelligence, where the AI system could collaborate with the human user rather than acting as a superior black box system in the given task (D. Wang et al., 2020). The assistant was intended to support teachers at critical stages of their lesson planning stage: at the beginning, during, and when finishing the plan, focusing on the envisioned AI values and capabilities in Phase 1. Full documentation of the prototype is provided in Appendix B.

The assistant aided in generating ideas during the early planning stage, as illustrated in Fig. 3. Subsequently, during the planning stage, the assistant offered suggestions to enhance and verify compliance with curriculum requirements. Finally, in the crucial stage of finishing the lesson plan, the assistant helped synthesize and consolidate the plan, ensuring a well-thought-out teaching strategy to streamline the teacher's workflow.

Each stage involved the teacher user initiating and validating the AI-assisted plan, reflecting the notion of an assistant. The prototype was designed to keep teachers in control without replacing the teachers' unique value in their creative work process.

The participants provided feedback on the prototype, praising the assistant's ability to summarize lesson plans. They expressed concern about the potential for misinformation from AI-generated ideation and suggestion stages, as stated by A, "I would not want them putting, here is a recommendation of a speech made by the Prime Minister but the Prime Minister never made that speech because it is a fake, a completely manipulated resource." The participants emphasized the importance of valid information sources and ethical teaching practices, leading to further experimentation to develop a contextually accurate and ethical AI assistant. It informed the subsequent experimentation activity to see the feasibility of building a contextually accurate and ethical intelligent assistant in non-commercial AI solutions.

4.2.3. Technical bridge

The technical bridge, a key element in our feasibility analysis, was identified as a useful tool to build a cross-domain conversation. It did so by evaluating the feasibility of meeting the participants' expectations and AI technical feasibility. This bridge, in the form of experimentation, adopted the challenges, strategies, and the prototype's feedback from the participants. Their valuable input, combined with the experimental results detailed in Appendix B, provided a comprehensive feasibility analysis on building a contextually accurate and ethical generative AI model. Contextual accuracy, in this instance, denoted an AI model that delivers precise results within the framework of the school curriculum guidelines (ACARA, 2024; QCAA, 2022). In addition, the ethical AI model signified that the AI model is trained using verifiable, factual documents and does not transmit any data to proprietary AI services. These results offer important considerations for the participants on the technical feasibility of building their envisioned AI platform.

Specifically, the experimental results inform the feasibility of building curriculum-specific generative AI models using non-proprietary AI models. However, more development needs to be done to build a contextually accurate independent generative AI model. Proprietary AI services, such as GPT4, were still a better option if accuracy was of utmost priority, with the risk of no control over the data input and ownership (Gupta et al., 2023). The curriculum-specific models were cost-effective, reducing computational expenses significantly. Memory usage was optimized, ensuring the training process remained within the bounds of accessible computational costs. The AI model's data processing methods were carefully designed to be transparent using government-curated and publicly available curriculum documents. The AI model's training was based on legitimate educational content, making the model more reliable and accountable.

Match curriculum objectives with key concepts based on ACARA (for a subject and year)

Teacher prompt

Based on these concepts, what are the matching curriculum objectives according to Australian curriculum standard (URL)?

Assistant output

Based on the underpinning concepts previously mentioned, here are some of the matching curriculum objectives according to the Australian Curriculum for Mathematics at Year 10 level:

Systems thinking:

- Develop an understanding of the connections between different mathematical concepts and apply this understanding to solve complex problems involving multiple concepts.
- Use mathematical models to represent and analyze complex systems in a variety of contexts.

Critical and creative thinking:

- Analyze and evaluate mathematical arguments and information, and identify flaws and weaknesses in reasoning.
- Apply creative problem-solving strategies to solve mathematical problems and develop new mathematical ideas.

...

Fig. 3. An example of the prototype outcome: An intelligent assistant matching curriculum objectives with key concepts.

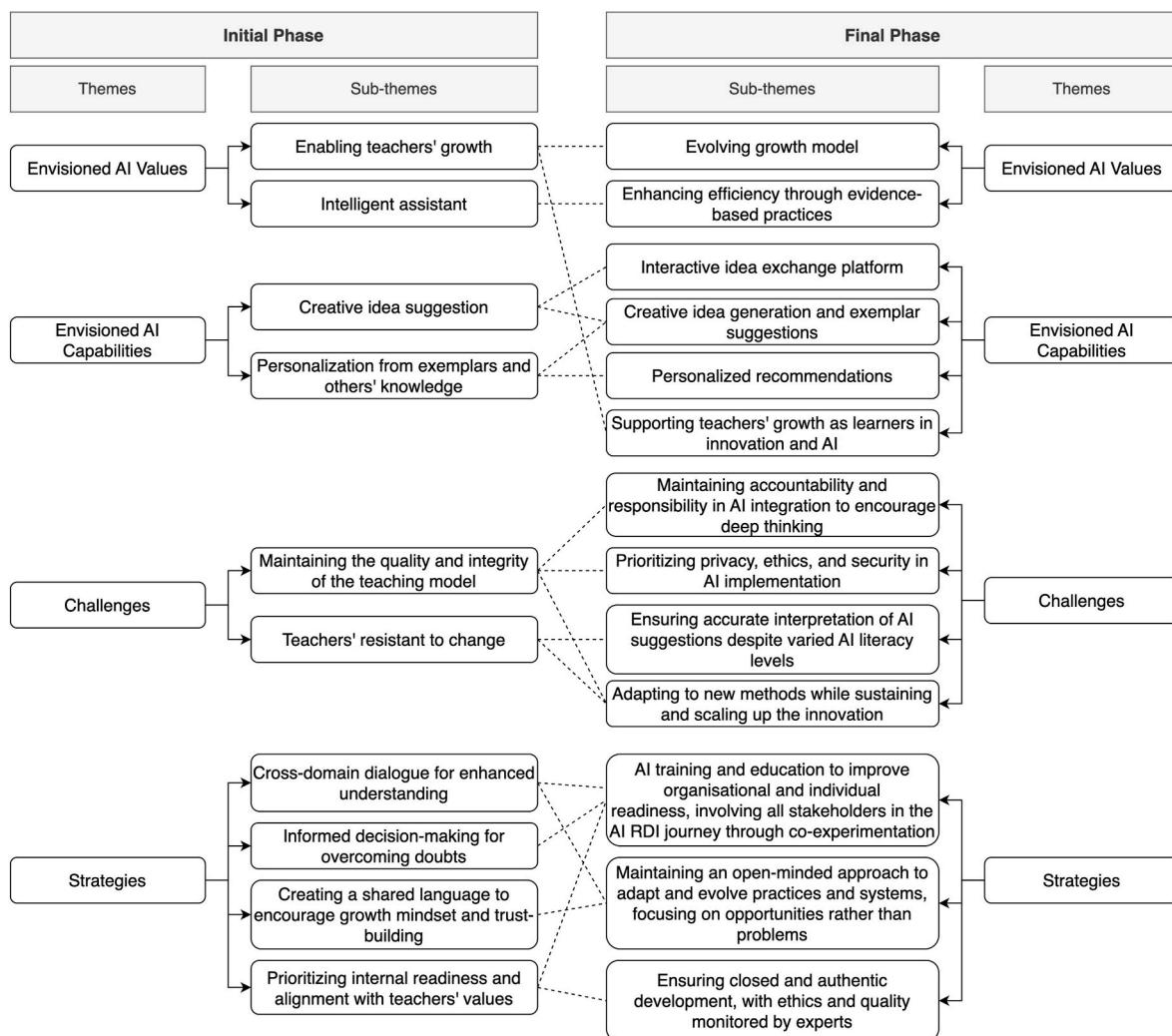


Fig. 4. The differences in themes between Phases 1 (initial) and 4 (final) reflected changes in participants' understanding and perception of AI. The changes are illustrated through the sub-themes connected through the dashed line.

4.2.4. Alignment with individual values and organizational vision

The collective themes that emerged in Phase 4 reveal a commonality across all sub-themes, extending the initial alignment of individual value. Along with individual values, alignment with the organizational vision is also apparent in all final sub-themes. The alignment with the individual values remained the same as in the envisioned AI value on the evolving growth model, which emphasizes the importance of enabling teachers' growth. Furthermore, the AI values and capabilities demonstrated more collective and organizational-level insight, such as enhancing efficiency by adopting evidence-based practice and supporting teachers' growth in innovation and AI. These sub-themes are consistent with the school's vision to be at the forefront of education innovation and the need to maintain evidence-based practice as an educational institution. The alignment of the school's vision with AI is further demonstrated through the final set of challenges and strategies. These challenges include maintaining accountability and responsible use of AI, as well as sustaining and expanding AI innovation. Furthermore, the strategies encompass AI training and education and adopting open-minded and evolving practices. These are all consistent with the organization's vision to advance education innovation while adhering to education regulations. The subsequent section provides complete details on changes across all sub-themes between Phase 1 and 4.

4.3. Changes in the understanding and perception about AI

Analysis of the data collected in Phases 1 and 4 revealed some common themes with evolving sub-themes. Fig. 4 provides a detailed description of these themes and their respective sub-themes, which can be grouped into four main categories: 'envisioned AI values', 'envisioned AI capabilities', 'challenges', and 'strategies'.

4.3.1. Envisioned AI values

The participants' answers about their understanding and expected AI capabilities formed one integral theme of their envisioned AI values. In the initial phase, A shared, "That is my big vision, and I aspire that people will not want to reject it or turn away from it." The initial AI values are the AI-enhanced planning platform to be an intelligent assistant that enables teachers' growth. These values changed, and the AI-enhanced platform became an evolving growth model as the participants understood better the adaptive and advanced nature of AI technologies, where they expected the platform to push teachers to innovate and learn constantly. Furthermore, they saw values in the intelligent assistant as being more specific in enhancing efficiency through evidence-based practices after seeing the capability of generative AI to be more aligned with the curriculums in Phase 2 of prototyping and experimentation.

4.3.1.1. Theme 1: final AI values. Sub-theme 1: Evolving growth model.

A: "Support growth" in "conceptual thinking, suggest provocations or key questions, the pathway for thinking."

D: "Novel ideas that lead to a mindset of playfulness and growth in teaching and learning."

Sub-theme 2: Enhancing efficiency through evidence-based practices.

A: "How do we collect evidence" that the planning has been done correctly "more efficiently?"

B: "Tool for building efficiency."

C: "As the data grows, it will be capable of helping the teachers further."

D: "Database of planning-specific resources."

4.3.2. Envisioned AI capabilities

The initial AI capabilities began with offering creative idea suggestions and personalization based on the knowledge of exemplars and other teachers. These were informed by the participants' initial

understanding of their general knowledge and their own AI tool exploration. These capabilities became more specific in the final phase, accommodating teachers across the school. In the initial phase, the AI platform was designed to suggest creative ideas to teachers and personalize their plans based on existing exemplary plans and those of other teachers. In the final phase, these functions evolved into an interactive platform for idea exchange and expanded the creative idea suggestion feature to include recommendations based on exemplar plans. Additionally, the personalization function transformed into personalized recommendations tailored to the specific needs of the teacher users. The initial AI value of enabling teacher growth was later articulated into a new specific capability, placing teachers as learners to innovate their practice and grow.

4.3.2.1. Theme 2: final AI capabilities. Sub-theme 1: Interactive idea exchange platform.

B: "Provoking teaching and innovation conversations across the school."

C: "Draw from the experiences of others."

D: "collaborative interdisciplinary platform", "springboard for collaboration", "synthesis of connection."

Sub-theme 2: Creative idea generation and exemplar suggestions.

A: "Collection of creative ideas of daily practice."

B: "Using AI to generate ideas to design problems", "producing sketches from the ideas, e.g. CrAIyon."

C: "Generate ideas", "Advance old ideas."

D: "Show how the planning approach looks like in practice" "Openness of ideas" – disposition – the flow of ideas.

Sub-theme 3: Personalized recommendations.

B: "Connecting curriculum to teachers' ideas (pedagogies and strategies)."

C: "Predict what people would need"

D: "Curriculum elaborations", "cross-curriculum possibilities" with options for potential differentiation.

Sub-theme 4: Supporting teachers' growth as learners in innovation and AI.

B: "Help to understand the curriculum specifics within the context of the teacher's learning potential."

C: "Continuous advancement"

D: Provide a "trial and error" platform before finalizing planning and "testing ideas and the responses."

4.3.3. Challenges

When discussing their experiences with AI innovation and observing other teachers, the participants shared their concerns about AI. In Phase 1, their challenges were related to social issues such as teachers' resistance to change and educational integrity. In Phase 4, the participants highlighted technological challenges in AI design, development, and adoption. This shift was due to their exposure to the opportunities and challenges of generative AI through prototyping and experimentation.

One particular concern that was discussed in Phase 1 was the need to maintain the quality and integrity of teaching models. This concern became more specific when the participants discussed the human-AI autonomy issue. They were worried that teachers might become too reliant on AI-enhanced platforms due to the capabilities of generative AI tools. The participants also discussed ensuring teachers remain accountable for AI-assisted content and maintain their deep thinking.

Additionally, privacy, ethics, and security in AI implementation emerged as a new challenge. The participants asked who would collect their data and for what purpose. Overall, the discussion highlighted the need for a balanced approach to AI adoption that takes into account both social and technological challenges.

4.3.3.1. Theme 3: final challenges. Sub-theme 1: Maintaining accountability and responsibility in AI integration to encourage deep thinking.

A: "Time-saving features of AI could short-circuit deep thinking and knowledge building." "could encourage a lack of responsibility."

B: "AI that supports teachers' thinking" since "Teachers could become reliant on the AI" and "not being responsible users."

C: "Once we have everything recorded digitally in the AI-enhanced platform, will teachers stop looking for and creating new ideas?"

D: "Corroboration, accountability, choice, alignment."

Sub-theme 2: Prioritizing privacy, ethics and security in AI implementation.

B: "Issue on accessibility: Some teachers work after hours due to the workload. How do we ensure the security of the AI system when inputting data, anywhere, anytime?"

C: "Protecting our IP"

D: "Who is collecting the data and why?"

Sub-theme 3: Ensuring accurate interpretation of AI suggestions despite varied AI literacy levels.

B: "There is a spectrum of literacy from novice, open to experiment, to power users who champion AI."

C: "Teachers struggle with some technological basics"

D: "Staff misinterpretation of AI use"

Sub-theme 4: Adapting to new methods while sustaining and scaling up the innovation.

A: How to scale up for "dispositions and immersive study time subjects across the school."

B: "Developing a relationship and trust in using AI in the platform in the coaching context."

C: "Time to train users"

D: "How might the integration of AI challenge the offered subjects?"

4.3.4. Strategies

Phase 1 generated a set of strategies to foster cross-domain dialogue, informed decision-making, and a shared language, which were implemented in Phases 2 to 3. These strategies were developed based on the expertise and knowledge of the project champions, who worked with other teachers to introduce new teaching methods.

Through the visual and technical bridges, we focused on cross-domain dialogue to ensure that the co-created AI assistant aligned with the participants' values and needs. By using a shared language in the prototyping phase, the team was able to better understand the participants' needs and align the project with their values.

As the project progressed, the participants recognized the importance of AI training and education for individual and organizational readiness. They also emphasized the need to focus on opportunities for AI integration rather than problems in order to adapt to the rapidly evolving AI landscape.

Finally, the participants proposed a new strategy for closed and authentic AI development to address concerns about reduced teaching quality and the loss of human interaction. This strategy involved collaboration between AI and education experts to ensure that the integration of AI technology would not compromise the human relational nature of teaching.

4.3.4.1. Theme 4: final strategies. Sub-theme 1: AI training and education to improve organizational and individual readiness, involving all stakeholders in the AI RDI journey through co-experimentation.

A: "Readiness assessment when onboarding" new users.

B: "Take teachers and other stakeholders on the AI journey and how it supports teachers' practice within the platform."

D: "How do we educate all?"

Sub-theme 2: Maintaining an open-minded approach to adapt and evolve practices and systems, focusing on opportunities rather than problems.

A: "Adaptive and evolving teaching and learning practice and system."

B: "AI as part of the teaching team."

C: "I am excited about the new AI-enhanced platform and its possibilities for generating ideas, data, and troubleshooting."

Sub-theme 3: Ensuring closed and authentic development, with ethics and quality monitored by experts.

A: "Build an echo chamber or closed system for authentic development."

C: "Not too concerned for our jobs" since "AI cannot read the room."

4.3.5. AI readiness

The participants' view on the school's AI readiness is one of the themes emerging from the Phase 1 to 4 data and evolved among the participants. At first, there was a lack of awareness and interest in the use of AI tools among the teachers in the school. The participants' responses regarding the school's AI readiness supplemented the analysis of the changes in their understanding and perception of AI.

4.3.5.1. Theme 5: AI readiness

4.3.5.1.1. Initial phase. A: "I could not answer that question because I have not really asked the teachers who have been using it, but we are one of the few schools that has allowed AI use to happen."

B: "The challenge is that some people are not believers."

C: "I guess it is in its early stages."

D: "I think there is only a small percentage of staff, and—I would say only a handful of staff—who would like to have a go because the others do not have the understanding yet."

4.3.5.1.2. Final phase. A: "There would be enthusiasm, but I do not believe the people are at a point to conceptualize the impact because they are struggling to understand the whole picture."

B: "Some teachers are curious about the potential of AI in the classroom."

C: "Teachers are currently using AI tools to source lesson activities or resources. They have also used AI tools to construct feedback for students, which is generally unsuccessful."

D: "Teachers are starting to ride the wave of AI, although less prepared than students."

5. Discussion

The research findings inform how co-creation contributes to bridging the knowledge gap between innovation champions and AI by integrating the champions' initial understanding and perception of AI, utilizing key elements to facilitate bridging the knowledge gap and achieving changes in the champions' understanding and perception of AI (see Fig. 5). The following subsections discuss the implications of the results in a general scope to address the research question.

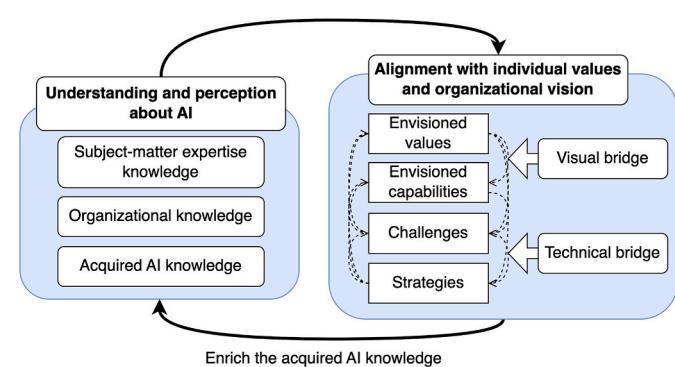


Fig. 5. Bridging the knowledge gap can be achieved through continuous cycles of value and vision-driven co-creation to enhance champions' understanding and perception of AI.

5.1. Source of knowledge for innovation champions' understanding and perception about AI

Several factors influence the champions' understanding and perception of AI, including their subject-matter expertise, experience in teaching and innovation, external exposure, and experience with AI. These factors shape their knowledge of AI, categorized into three scopes: general knowledge of their subject-matter expertise, organizational knowledge, and learned knowledge of AI.

For example, initially, champion A, who had no prior experience with AI, articulated their envisioned AI capabilities from their subject-matter expertise and their experience in teaching and innovation. They did not express much concerns on AI technical capability except for expecting the developed AI-enhanced platform to align with the educational standard, as they knew little about AI.

The champions' personal values, which contribute to their learning approach to AI, fall under the general knowledge of their subject-matter expertise. The general knowledge of subject-matter expertise represents the champion's personal value which contributes to their learning approach on AI, consistent with the previous work on the role of personal value in learning approach (Gamage et al., 2021). In designing technology that accounts for human values, stakeholders' values must be considered to sustain their engagement in long-term organizational innovation (Friedman, 1996; Friedman et al., 2013; Umbrello & van de Poel, 2021).

Organizational knowledge is critical, especially for organizational champions, as it refers to their understanding of the organization's operational protocol or business process. In the context of the study, the operational protocol of K-12 schools was influenced by national education and state government policies regarding the use of AI in schools, and their innovation journey (National AI in Schools Taskforce, 2023; QCAA, 2024). These policies were still under development during the data collection period but were actively communicated to schools. The national policy required schools to educate students about how generative AI tools work, including their potential limitations and biases. It also emphasized that teachers had to be the subject-matter experts in the classroom. Additionally, the state government policy mandated the school to develop ethical guidelines for AI use and update their school-specific policy to clearly communicate expectations in teaching, learning, and assessment processes. The research subject, the school itself, was one of the few in its area to adopt AI due to its organizational vision and historical knowledge and experience in developing the lesson planning platform that forward-thinking was essential. This knowledge was evident in participants' understanding of AI, as the school encouraged teachers to use AI tools. For example, D mentioned using AI tools to create teaching resources, "I have used AI to develop some cards and teaching tools. So we have really transitioned and thought about how we use AI to create a particular image or some resources that we are creating, which has been cool." It indicates the impact of organizational knowledge in individual learning work (Crossan et al., 1995; Senge & Sterman, 1992; Vătămănescu et al., 2022). The champions' organizational knowledge informs the requirements to initiate and sustain innovation, reflecting organizational innovation and knowledge management works (Antunes & Pinheiro, 2020; Jiménez-Jiménez & Sanz-Valle, 2011; Tohidi et al., 2012).

The champions' acquired knowledge about AI from their interaction with external mediums, coupled with their inherent knowledge of subject-matter expertise and organization, shapes their overall understanding of AI. This approach aligns with the constructivism learning theory, which posits that individual learning is built upon existing knowledge (Piaget, 1976; Reynolds, 2016). Social learning is also significant in AI learning, where observation of exemplary people, such as teaching, innovation, and AI experts, impacts individual learning (Bandura, 2001; Kaliisa et al., 2022).

In summary, the champions' understanding and perceptions of AI are shaped by their subject-matter expertise, organizational knowledge, and

acquired knowledge of AI.

5.2. Key elements that facilitate bridging the knowledge gap between champions and AI through Co-creation

The findings inform how co-creation helps fill the AI knowledge gap among champions and enhances their capacity for AI innovation, as seen in the changes across the envisioned AI values, capabilities, challenges, and strategies between the initial and final phases. The co-creation was built based on continuous conversations with the champions and providing a collaborative environment for knowledge sharing and learning. They also learned about the practical aspects of AI implementation and integration within their organizational context. The co-creation enabled champions to actively participate in designing and testing AI tools and solutions. This hands-on experience helped them demystify AI, understand its potential impact on their roles and processes, and identify opportunities for its effective utilization (Kolb, 2014; Morris, 2020).

Specifically, visual and technical bridges are found to help bridge the knowledge gap between the champions and AI. In the form of prototyping, the visual bridge became a platform for developing common languages through visuals, informing the need for more domain-specific generative AI models aligned with the curriculum and fulfilling industry regulations. This finding corresponds to the previous works on the role of visualization tools, such as prototypes and sketches, as a boundary-spanning tool in cross-domain digital co-creations (Hevner & Gregor, 2022; Pershina et al., 2019). Technical bridge, in the form of experimentation, aimed to evaluate the feasibility of achieving domain-specific and privacy-preserving generative AI tools, taking into account the champion's feedback and their concerns and recommended strategies. The experimentation results inform the champions on important considerations of developing AI tools from engineering perspectives to bridge their expectations and the current capability of AI technology, which could be seen from their shifts in identifying challenges and strategies in the final phase. This approach introduces new exposure and experience of AI technology for the champions, shaping their knowledge and perception of AI. It extends existing theoretical works on technological acceptance, where social influence and facilitating conditions that impact intention and behavior in technology acceptance can be actualized through co-creation involving prototyping and experimentation in the case of AI projects (Davis et al., 1989; Gansser & Reich, 2021; Venkatesh et al., 2016).

The significance of the co-creation elements connects with and expands on previous work in teacher education or training programs in AI. The findings suggest how such programs can benefit from considering a new lens in presenting AI to teachers and value-driven collaborative learning, integrating visual and technical representations.

The initial phase of the study started with introducing the AI-enhanced platform as a supporter, with the champions as collaborators, as exemplified in the prototyping. However, in the final phase, the champions viewed the AI-enhanced platform as an empowerment tool with teachers as the leaders in decision-making at every stage of the planning process, as seen in the shift in themes between the initial and final phases. For instance, D suggested at the final phase for the AI-enhanced platform to "provide a trial and error platform before finalizing planning." This finding extends prior research on paradigms of AI in education, illustrating how co-creation is employed to transition teachers from the second paradigm of AI learner as a collaborator to the third paradigm of AI learner as a leader (Ouyang 2021).

The study shows how co-creation impacts teachers' professional development in AI technological pedagogical and content knowledge (TPACK) (Ng 2021). It highlights the critical importance of collaborative learning aligned with individual and organizational values, thereby increasing their internal motivation and experience in line with the andragogical model in TPACK (Carvalho, 2022, Chaipidech et al., 2022).

Overall, the co-creation activities catalyzed knowledge transfer, skill

enhancement, and mutual understanding, highlighting the importance of understanding the nature of AI technology, technical strategy and its application in context to reduce concern and improve readiness (Orlikowski & Gash, 1994; Song et al., 2024). Ultimately, the activities empower champions to make informed decisions about AI innovation and leverage its potential in their organizational involvement.

5.3. Alignment of value for bridging the knowledge gap

The organizational vision is found to be a critical driver. The school's vision of being at the forefront of education innovation is inherent throughout all the findings. For instance, the envisioned AI value in teachers' growth and strategies around shared language to encourage a "growth mindset" and AI training and education while maintaining the integrity and accountability of the AI-enhanced platform align with the organizational vision. In addition, the feedback of the prototyping and experimentation highlights the need for contextually accurate and ethical AI-enhanced platforms, which are aligned with the organizational vision and individual values to uphold the quality and integrity of teaching and maintain teachers' distinct strength and human relational nature in teaching relationships. For instance, C, who had negative and neutral initial perceptions, did not reject AI outright, "Still, we certainly want to embrace AI as a part of what we are doing in the future, not only with the platform being AI-enhanced but also with how we utilize that as a tool for our teachers and students in our school."

The alignment with the individual value is evident through a varied understanding of AI initially, which is influenced by the champion's value towards their role as teachers and pedagogical coaches. As B explicitly stated in their discussion on AI values and challenges, "As a coach, I believe that while we may want things to happen quickly, we also need to be patient. This applies to the school's overall vision and how it will evolve in the future."

Furthermore, the alignment of value can be seen from the champions' perception of AI, where individual values can be actualized from their subject-matter expertise knowledge, organizational knowledge, and acquired knowledge of AI, as shown in the findings. The perception of AI from their subject-matter expertise lens correlates with existing studies on AI value based on its impacts on the human expert role (Chowdhury et al., 2023). Although existing works have not directly discussed AI value from subject-matter expertise, the findings inform its importance in how employees, specifically champions, view AI from their expertise lens. The perception from the organizational lens perspective corresponds to existing work on AI value reliance on its impact on the organization's business process (Enholm et al., 2022; Sjödin et al., 2021). It also correlates to technology acceptance, identifying organizational perceived benefits, costs, and competence for competitive advantage (Gansser & Reich, 2021; Kuan & Chau, 2001; Ramakrishna & Lin, 2002).

In addition, the perception of AI is related to how the champions see AI value within the organization. It is evident across the phases that the managers voiced their envisioned AI capabilities, challenges, and strategies based on how they saw AI value within the organization, such as how the initial AI value of enabling teachers' growth shifted in the final phase into the value of an evolving growth model and AI capability of supporting teachers' growth as learners in innovating teaching practices. This finding affirms that the individual learning approach leads to personal value and perception of AI, which has been suggested in previous works debating AI-human dynamics and the evolution of the workforce (Korteling et al., 2021; Wu et al., 2021). It also corresponds to technological perception theoretical works that individual intention to use technology is impacted by their perceived value (Davis et al., 1989; Gansser & Reich, 2021). The findings in this study add a new lens that individual learning approach relates to how they see AI value from their expertise.

The study's findings inform considerations of AI curriculum design by highlighting the importance of individual and organizational values.

The findings emphasize the significance of self-realization in AI curriculum design, confirming previous research that emphasizes the role of teachers' perception and competence in AI as the classroom orchestrator (Yang, 2022). The study also supports existing research on AI curriculum design, emphasizing the need to address teachers' proficiency in AI, including knowledge, skills, and attitudes, through problem-based co-creation (T. K. F. Chiu et al., 2022; Su & Zhong, 2022). Embedding the individual value to students, as the learners in AI curriculum, also aligns with the self-determination theory (T. K. F. Chiu & Chai, 2020). The role of organizational vision contributes to the literature by exploring the integration of cultural relevance in AI curriculum design (Yang, 2022). The findings also demonstrate how teachers' involvement in AI innovation and integration influences non-specialist AI teachers' knowledge, impacting AI curriculum design for non-computing courses (Southworth et al., 2023; Xu & Babaian, 2021).

In conclusion, the alignment of value between the organizational vision and individual values plays a crucial role in bridging the cross-domain knowledge gap across the study phases. The findings of this study highlight the importance of AI innovation that align with the organizational vision and individual values to uphold the quality and integrity of existing human-driven operational standards. The champions' perception of AI value from their subject-matter expertise and organizational lens perspective provides a new lens to understand how employees view AI in their work. The study also emphasizes the need for an individual learning approach that leads to personal value and perception of AI, which can support employees' growth as learners in innovating industry practices.

5.4. Shifting role of champions through their understanding and perception about AI

The changes in the champion's articulation of AI values, capabilities, challenges, and strategies show the champions' shifting role from boundary spanners between upper management and frontline employees and subject-matter experts into assessors of the organization's AI readiness and early adopters.

The fundamental role of champions outside the AI co-creation project is as boundary spanners, acting as the link between upper management and frontline employees in informing their needs in their respective roles and the organization. This role is evident in the research, where the champions discussed their daily responsibilities, such as "Evaluate the quality of the plans and generate reports for senior leaders to identify potential issues". Additionally, their role as boundary spanners is evident in how they communicate the need for a new planning platform leading to the AI project, taking into account the perspectives of both frontline employees and upper management. Their ability to bridge the gap between different levels of the organization was crucial in driving the adoption of new technologies (Gruenhagen et al., 2022; Harding et al., 2014).

In addition, the findings show that the champions acted as the subject matter experts. They are the primary source of information and guidance in the organization's innovation journey and goals. They provide the context and rationale for the AI co-creation project, as exemplified in the participant's inputs in Phase 1. Additionally, their knowledge of the organization's historical journey and their expertise in education play a significant role in informing the project's design and development of the AI-enhanced platform. For example, they shared the organization's value towards openness and trust-building in the teaching style, which was previously more isolated and closed off:

"School teachers are very institutionalized. When you are trying to bring about change because education is going through a revolution, you are talking about something very traditional, stuck in a world that is exponentially accelerating and changing. You have this thing that has never changed, and the people inside it find it very hard to change because they have never been outside that system."

In the context of education institutions, the champions also have a middle leadership model that enables them to comprehend and provide information on the organizational culture, enthusiasm around AI, and subject-matter expertise while influencing teachers' attitudes toward AI (De Nobile, 2018; Kör et al., 2021).

The project experience enriched the champions' understanding and shifted their perceptions about AI, which equipped them to be cross-domain specialists for AI innovation in the organization. For instance, the shift in the challenges in Phase 4 results show that their learning about AI in the project enabled them to identify challenges not just from their subject-matter expertise in education and their role of socially interacting with other teachers but also from technological perspectives on the challenges for teachers as users and organization as the platform holder, resulting in socio-technical challenges of AI for enabling teachers' growth in the project.

Furthermore, the insights provided by champions played a crucial role in shaping the organization's readiness for AI (Phase 3). For example, AI readiness was a pivotal theme in providing a learning environment for the managers' by identifying the starting point through initial AI readiness and the learning progression through final AI readiness. It shows that the critical role of enhancing champions' capacity in understanding AI's social and technical components in the project leads to enhanced overall organizational learning capability and innovation (Jiménez-Jiménez & Sanz-Valle, 2011; Kordab et al., 2020). Empowering the champions to be cross-domain specialists also helps them to become lead users of the AI-enhanced platform (Venesz et al., 2022; von Hippel, 1986).

This finding corresponds to the champions' identity as the first wall of innovation as controller, controlled, resister and resisted, which means getting them on board in the innovation is most critical (Harding et al., 2014). The interrelations between the nature of their work of being used to unknowns and unpredictability in innovation and involvement in the design and development of the AI-enhanced platform lead the champions in the study to explore more AI tools, regardless of their initial perceptions about AI. It provides an example of how professional adults can learn new technology, such as AI, adding a lens to existing works about professional development, especially for teachers (Chaipidech et al., 2022). It correlates with humanism learning theory, where meeting the learner's unique perception, personal value, and professional growth needs (i.e., employees) will influence their behavior (DeCarvalho, 1991; Prem, 2024; Scuotto et al., 2023).

6. Conclusion

This paper presents a multi-phase study to address the issue of closing the knowledge gap between innovation champions and AI by conducting co-creation, illustrated by the study of a case of Generative AI innovation in a K-12 school. The outcomes of the research conclude that the champions' understandings and perceptions of AI are shaped by a combination of their organizational knowledge, subject-matter expertise knowledge, and acquired knowledge of AI. These constructs of understanding and perception of AI demonstrate a cause of the knowledge gap among champions in non-computing firms. They are related to the champion's way of thinking through their organizational and subject-matter expertise knowledge and their accessibility to AI knowledge. The study also shows key elements that facilitate bridging the knowledge gap: alignment of value, capabilities, socio-technical challenges, and strategies. Bridging the knowledge gap starts with (1) alignment of value to build shared AI values connecting the champions' background knowledge and AI technical capabilities, (2) extending the shared values to articulate AI capabilities that meet the champions' needs, (3) extending the shared values and capabilities for identifying shared socio-technical challenges between the champions' industry-specific and AI engineering challenges, and (4) identify shared strategies that connect the champions' experiences and the shared values, capabilities, and challenges to build trust and improve the AI readiness

of the champions, as critical users and collaborators of the AI innovation. The research informs that this journey must start with values and focus on opportunities to address the gap in understanding and perception of AI. Finally, the study unravels how co-creation can be used to increase experience and exposure to AI, leading to filling in the knowledge gap and learning from the example of designing and developing generative AI solutions for K-12 teachers with the champions.

6.1. Theoretical contribution

The research significantly contributes to theory in this context by providing a method to approach the exploration of the knowledge gap in AI in non-computing organizations. It uses co-creation to illustrate the bridging of knowledge gaps in AI innovation management. The findings emphasize the importance of shifting champions from a focus on challenges to values alignment. It shows how co-creation elements can help build knowledge about AI, showing a relationship between co-creation and learning theories (Carvalho et al., 2022; Galvagno & Dalli, 2014; Kolb, 2014).

The study also contributes to experiential and organizational learning theories on the impact of co-creation. The champions' involvement in prototyping, experimentation, and co-design workshops fosters experiential, collaborative learning of AI tools for their organization and work. It adds to the impact of collaborative learning theory, suggesting that experience influences behavioral intention and knowledge (Kolb, 2014; Morris, 2020). The collaboration factor also contributes to the organizational learning theory, demonstrating its potential to bridge the knowledge gap in AI, particularly in shared vision, personal mastery, and systems thinking (Ng et al., 2021; Senge & Sterman, 1992).

The findings emphasize that aligning vision and values is critical for shaping the perception of AI in the organization. This adds depth to the current understanding of how attitudes impact technological adoption and innovation. It also adds a new dimension to existing technological acceptance theories, highlighting the impact of vision and values on AI technological perception (Davis et al., 1989; Gansser & Reich, 2021; Venkatesh et al., 2016).

This findings extend the Value Sensitive Design theory, highlighting the importance of integrating stakeholder values in designing technological solutions (Friedman, 1996; Friedman et al., 2013; Umbrello & van de Poel, 2021). Organizational and individual values emerge as critical elements shaping the knowledge and perception of AI, underscoring the importance of considering the theory in co-designing AI systems centred on organizational and individual values.

The research underscores the pivotal role of champions in bridging knowledge gaps and facilitating design thinking for both technological and organizational innovation. Existing theories of champions have suggested their role as change agents in organizational innovation, particularly in diffusing and synthesizing information across organizations (Birken et al., 2013; 2016; Gruenhagen et al., 2022). The finding on the role of champions in co-creation as early adopters and champions indicates that when managers see value in the innovation, they can become champions in promoting it across the organization.

The study also highlights ethical challenges and other issues in AI specific to education. These include the need for contextually accurate AI results based on legitimate education resources and privacy-preserving AI systems that protect teachers' and students' data to build trust with the AI-enabled education system. It extends existing works in human-centred learning analytics and the future of education with AI (Alfredo et al., 2024; Srinivasan, 2022). The co-created AI-enhanced platform also provides a tangible case of addressing the human-AI autonomy issues, particularly with teachers (Siemens et al., 2022).

In conclusion, this paper significantly contributes to the research field by showcasing how co-creation with innovation champions extends foundational learning theories and redefines technological design and acceptance. It highlights the profound role of vision and values in

shaping technological perceptions and practices.

6.2. Limitations and future research

This study is based on a case that delves into a selected number of champions in a K-12 school due to its longitudinal nature. The limited number of participants, only four in this case, constrained the statistical significance of the findings. Therefore, the analysis considers the diverse backgrounds and expertise of the participants, comparing them with the existing body of literature to comprehend how and why their understanding and perceptions shifted throughout the journey. Additionally, the educational policies and considerations discussed in this research may only be applicable to some countries and regions, as the case study was conducted in a Queensland K-12 school. Hence, the analysis focuses primarily on the teachers' considerations in navigating generative AI values for their practices rather than the entire teaching process and culture.

Therefore, future research could explore the integration of AI across various schools and educational systems, enhancing the robustness and applicability of these findings in the education sector and beyond. Exploring the long-term impacts of co-creation and involving a wider range of teachers with diverse expertise and roles will provide insights into how co-creation fills in the knowledge gap, improves AI literacy, and affects teaching practices. Furthermore, delving into the knowledge gap between AI and champions from other industries will inform how the diverse subject-matter expertise impacts their understanding and perceptions of AI, forming the knowledge gap. This research serves as a foundation for future research and practical applications of generative AI in creativity and teaching from the teachers' perspective, stressing the significance of multifaceted considerations and experts in education and AI involvement. Future research may also explore cross-disciplinary perspectives from end-users and engineers, examining shared values through a co-creator lens to reveal further insights into long-term values for sustaining and refining value-driven AI innovation.

6.3. Practical implications

This research demonstrates how co-creation with the champions can be effectively applied to bridge knowledge gaps and foster enduring innovation. It offers insight for professionals and organizations, extending beyond educational institutions to the broader industries. Educators can use the insights to navigate the evolving AI landscape to foster an innovative environment while managing stakeholders' concerns. Educational leaders and champions can initiate cross-domain collaborative AI projects based on their institution's vision and enhance the institution's innovation capability. Policymakers of education institutions can use the knowledge sources and key elements identified in the study to develop AI education and training programs that incorporate value-based co-creation activities. Champions across industries can effectively apply the findings to lead AI co-creation projects, bridging knowledge gaps and fostering collaboration between technical and non-technical teams. Insights into aligning AI tools with organizational values can help AI developers and technologists build a shared language and common understanding with non-technology professionals and firms. The research underscores the importance of a comprehensive roadmap for AI innovation, given the gap between champions' expectations and technical limitations, which will inform AI researchers and policymakers working on strategic planning for AI development and implementation. Finally, innovation managers can leverage the findings to enhance cross-domain collaboration and ensure that AI initiatives contribute to organizational innovation.

CRediT authorship contribution statement

Elizabeth Irenne Yuwono: Writing – review & editing, Writing – original draft, Visualization, Software, Investigation, Formal analysis,

Data curation, Conceptualization. **Dian Tjondronegoro:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Software, Resources, Project administration, Methodology, Conceptualization. **Carla Riverola:** Writing – review & editing, Visualization, Supervision, Conceptualization. **Jennifer Loy:** Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.caai.2024.100272>.

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