

Cultivating an evidence-based innovation mindset in allied health professions

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Abstract

Purpose – Healthcare is a rapidly evolving field that demands allied health professionals who are both innovative and grounded in evidence-based practice. This study addresses the growing need to prepare allied health professionals to lead and drive innovation by conceptualising the dimensions of an evidence-based innovation mindset, evaluating the extent to which a targeted educational intervention cultivates this mindset among allied health students, and outlining the pedagogical implications.

Design/methodology/approach – Using evaluation research, 52 quantitative survey responses were collected before and after the intervention, and 21 interviews were conducted after the intervention. Data were analysed using inferential statistics and reflexive thematic analysis and synthesised to explore students' perceived changes in their evidence-based innovation mindset.

Findings – Survey results revealed significant differences for four dimensions of the evidence-based innovation mindset, specifically increases in individual entrepreneurial orientation, innovation self-efficacy, persistence, and research competence. The increase in learning orientation was not statistically significant. The latent themes revealed how participants gradually developed confidence as innovators and researchers through hands-on experience. They valued authentic innovation underpinned by persistence and flexible thinking, recognised the reciprocal relationship between research and innovation, and reported feeling capable of making real-world impacts in their future careers using innovation and research skills.

Originality/value – The study conceptualises an evidence-based innovation mindset for the allied health professions. It demonstrates the value of cultivating this mindset through an experiential problem-based intervention, highlighting the pedagogical need to renew healthcare curricula by incorporating evidence-based innovation.

Keywords Evidence-based innovation mindset, Project-based learning (PjBL), Experiential learning, Allied health, Occupational therapy

Paper type Research article

Introduction

Healthcare is undergoing rapid transformation, requiring allied health professionals to be innovative (Lim *et al.*, 2024; Li and Aflatoony, 2025; Liu *et al.*, 2017). Advances such as telemedicine, virtual therapy platforms, and 3D-printed personalised assistive devices are reshaping models of care (Li and Aflatoony, 2025). Since the COVID-19 pandemic, workforce shortages and accelerating technological change have challenged educators to better prepare

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graduates for increasingly complex and rapidly evolving environments (Lim *et al.*, 2024; Gill *et al.*, 2024; Sreenivasan and Suresh, 2022).

These shifts are significant for allied health professions, including occupational therapy, physiotherapy, speech pathology, psychology and social work, where market-driven reforms focus on increased client choice and control (Gilbert Hunt, 2017; Bourke-Taylor *et al.*, 2021). There have been global policy shifts, such as the United Kingdom's emphasis on technology-enabled innovation prioritising patient choice (Charlton and Rid, 2019) and Australia's restructured disability funding (e.g. National Disability Insurance Scheme). These changes require the responsive redesign of educational approaches to prepare health graduates for emerging contexts. Sharma *et al.* (2022) call for healthcare curricula to prepare clinicians to lead innovations for improved patient outcomes. Similarly, Lim *et al.* (2024) and Sreenivasan and Suresh (2022) emphasise the importance of healthcare innovations and preparing future clinicians to introduce innovations, collaborate with researchers and communities, and confidently navigate the dynamic labour market. These trends underscore the need for allied health professionals to enter the workforce with an innovation mindset underpinned by strong research skills.

In allied healthcare professions like occupational therapy, evidence-based practice remains a critical foundation for accreditation and professional competence (Occupational Therapy Board Australia, 2018). These standards require practitioners to conduct and apply research to guide clinical decision-making (Thomas and Law, 2013). This foundation ensures innovations introduced into practice are safe, effective and address clients' needs. Contemporary care models also position service users as active partners in problem-solving (Barclay *et al.*, 2020), strengthening the expectation that clinicians combine research skills with an innovation mindset. An innovation mindset combines entrepreneurial thinking with evidence-based approaches to develop novel solutions to healthcare environments and respond flexibly to healthcare system challenges (de Villiers Scheepers *et al.*, 2018; Maritz *et al.*, 2022). Although occupational therapy regulatory bodies do not explicitly identify innovation and entrepreneurship as graduate capabilities, graduates should nonetheless be equipped with research and innovation skills to ensure innovative, client-centred service delivery. This is because the ability to adopt new approaches and simultaneously critically evaluate solutions is central to effective professional practice.

Despite growing recognition of innovation and evidence-based research capabilities in allied health curricula, most programs develop these capabilities in isolation, representing a significant gap. Scoping reviews indicate that most occupational therapy capstone programs only focus on developing research skills (Kaldenberg and Delbert, 2024; Krusen *et al.*, 2020). Only a limited number of studies explore how entrepreneurship and innovation skills can be developed in healthcare students (Williams *et al.*, 2024; Panther *et al.*, 2019; Boore and Porter, 2011). Further, these skills have generally been considered from business disciplinary perspectives (Maritz *et al.*, 2019) rather than from a healthcare perspective. Therefore, allied health capstone units tend to focus on developing either research or innovation capabilities and have not explored how educational interventions can cultivate both. This paper addresses this underexplored area by integrating the development of both capabilities as an evidence-based innovation mindset.

This study defines the dimensions of an evidence-based innovation mindset for allied health students and evaluates the *InventOTive* intervention designed to develop it. The intervention is a project-based learning (PjBL) experience that simultaneously develops innovation and research capabilities. Using an evaluation approach, we assess the intervention's impact on the development of an evidence-based innovation mindset. The study contributes to the literature in three ways. First, we integrate entrepreneurship theory with occupational therapy literature, providing a conceptual foundation for the evidence-based innovation mindset in healthcare. Second, using both survey and interview data, we evaluate how the PjBL intervention equipped allied health graduates. Finally, our conceptualisation and evaluation findings have pedagogical implications for how healthcare educators can cultivate

an evidence-based innovation mindset. This mindset means graduates will be able to innovate when working within community organisations or as clinicians in dynamic healthcare environments.

Literature review

Innovation and research capabilities for evidence-based practice are increasingly recognised as essential for occupational therapists working in dynamic, client-centred healthcare environments (Bourke-Taylor *et al.*, 2021). Curriculum renewal in occupational therapy programs has introduced diverse capstone and work-integrated learning units, such as community-based innovation projects (Gill *et al.*, 2024; Williams *et al.*, 2024), placements that cultivate entrepreneurial behaviour (Thew *et al.*, 2018) and non-traditional fieldwork (Gilbert Hunt, 2017). These opportunities have enabled students to design or implement innovative service approaches and develop entrepreneurial and innovation skills. However, most studies are descriptive cases (Panther *et al.*, 2019; Chandra *et al.*, 2024) and do not integrate research capabilities with experiential innovation projects. Scoping reviews and qualitative studies (Kaldenberg and Delbert, 2024; Stephenson *et al.*, 2020; Teng *et al.*, 2024) indicate that occupational therapy capstone units continue to focus primarily on research competence. Consequently, Lim *et al.*'s (2024) systematic review of 572 studies has called for healthcare educational institutions to develop interventions that can cultivate an evidence-based innovation mindset that integrates innovation and research capabilities. The current study addresses this gap by conceptualising the dimensions of an evidence-based innovation mindset and designing the *InventOTive* intervention as a problem-based learning project to cultivate this mindset.

Cultivating an evidence-based innovation mindset

Innovation requires the generation and implementation of novel ideas resulting in new products, services or processes that deliver beneficial socio-economic outcomes (Organisation for Economic Co-operation and Development, 2010; Kogabayev and Maziliauskas, 2017; Popadiuk and Choo, 2006). Although widely studied in business disciplines, the application of open innovation, entrepreneurial behaviour and social innovation (de Villiers Scheepers *et al.*, 2018; Bodolica and Spraggon, 2021; Lindberg *et al.*, 2017) in healthcare remains underexplored. Prior studies suggest that an innovation mindset is cultivated more effectively through experiential, problem-based learning than traditional knowledge transfer (de Villiers Scheepers *et al.*, 2018; Lindberg *et al.*, 2017).

An evidence-based innovation mindset integrates entrepreneurship theory and social innovation literature (Maritz *et al.*, 2022; Covin *et al.*, 2020; Barnes and de Villiers Scheepers, 2018; Van Gelderen, 2012; Duckworth *et al.*, 2007; Williams *et al.*, 2024) with evidence-based practice in the allied health literature (Bourke-Taylor *et al.*, 2021; Palmer *et al.*, 2023) as a theoretical foundation. Entrepreneurship theory contributes an understanding of individual agency, opportunity recognition and taking proactive actions under uncertainty to introduce novel solutions (Covin *et al.*, 2020; Van Gelderen, 2012), while creating social value and upholding professional responsibility to address allied health challenges (Williams *et al.*, 2024). Complementing these dimensions, evidence-based practice in allied health emphasises systematic engagement with research evidence, clinical expertise and patient values, and ongoing robust evaluation using research methods to ensure solutions are effective (Bourke-Taylor *et al.*, 2021; Palmer *et al.*, 2023). The evidence-based innovation mindset integrates these dimensions by combining innovation capabilities with research-informed rigour. It incorporates the capacity to generate, test, adapt and implement novel solutions that are both opportunity-driven and scientifically validated. Therefore, we conceptualise this mindset as comprising five dimensions: individual entrepreneurial orientation (IEO), innovation self-efficacy (ISE), persistence, a learning orientation, and research competence (see Figure 1).

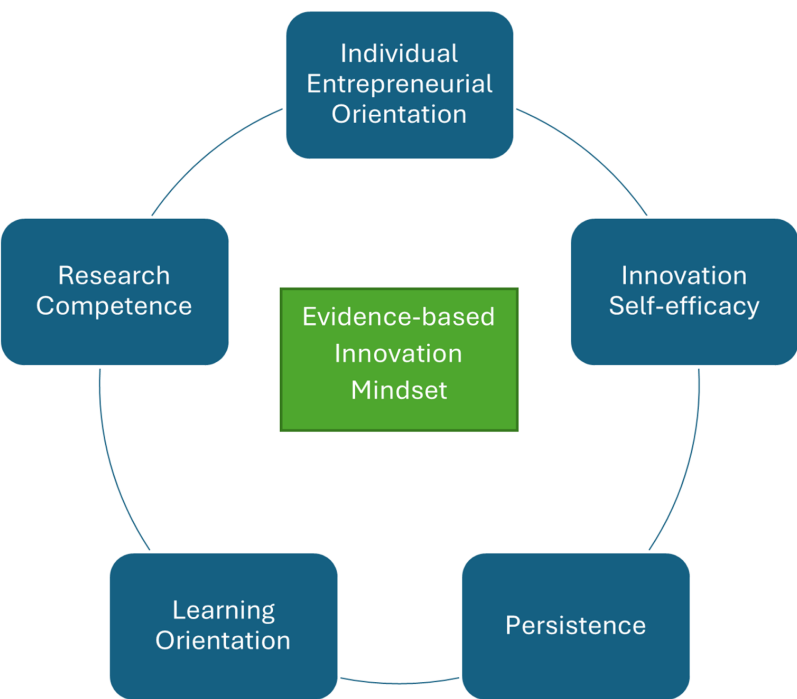


Figure 1. The evidence-based mindset comprised of five dimensions: individual entrepreneurial orientation, innovation self-efficacy, persistence, a learning orientation, and research competence. Source: Authors’ own work

Individual entrepreneurial orientation

IEO is the propensity to act entrepreneurially, driven by beliefs, values, practices and decision-making that enable individuals to respond proactively to change (Bolton and Lane, 2012). It consists of three interrelated components: innovativeness, proactiveness and risk-taking (Covin *et al.*, 2020). Innovativeness refers to creative thinking that develops novel solutions, challenges conventional approaches, and implements new ones. Proactiveness denotes an action orientation, taking initiative by anticipating future needs and addressing challenges, rather than passively reacting to external stimuli. Risk-taking propensity relates to the willingness to engage with uncertainty and to experiment with alternative solutions, investing time, effort and resources to implement them (Pidduck *et al.*, 2023). Together, these underpin an adaptive, opportunity-driven mindset, which can be cultivated through experiential learning (Barnes and de Villiers Scheepers, 2018).

Innovation self-efficacy

ISE relates to an individual’s belief in their ability to generate and implement innovative solutions (Ahlin *et al.*, 2014). This closely aligns with entrepreneurial action and is a strong predictor of the intention to innovate (Douglas and Fitzsimmons, 2013). Self-efficacy denotes individuals’ beliefs about their ability to complete tasks and achieve desired goals (Bandura and Walters, 1977), which can significantly influence motivation and problem-solving (Wood and Bandura, 1989). While individuals may possess equivalent capabilities, those with higher ISE are more likely to persist in tasks and demonstrate sustained effort (Bandura and Walters, 1977). Self-efficacy is domain-specific, meaning individuals may feel confident in their

problem-solving abilities in one context, but not another (Ahlin *et al.*, 2014). Therefore, educational interventions should include mastery experiences, vicarious learning, social engagement and emotional support to enhance ISE (Van Dinther *et al.*, 2011). Although creativity is a starting point for innovation (Amabile *et al.*, 1996), persistence is needed to overcome the inevitable challenges of implementing novel solutions.

Persistence

Persistence is strongly tied to innovation outcomes, denoting a sustained effort towards goals despite adversity (Van Gelderen, 2012). It enables individuals to maintain energy and motivation even when confronted with setbacks (Baum and Locke, 2004). Persistence has been linked to entrepreneurial behaviour and goal commitment, with individuals continuing to pursue objectives despite the emotions associated with both successes and failures (Mooradian *et al.*, 2016; Uy *et al.*, 2017). Although some researchers argue that persistence and passion should be included as dimensions of IEO (Santos *et al.*, 2020), this paper focuses specifically on persistence in the context of allied health, which prioritises clinical rigour. Our conceptualisation of persistence also includes the willingness to pivot; that is, adjust or refine an innovative solution as new evidence emerges or circumstances change (Mooradian *et al.*, 2016).

Learning orientation

A learning orientation is the predisposition to continually seek, acquire and apply knowledge, underpinning the ability to make informed decisions and adapt innovation evidence based on emerging knowledge (Alerasoul *et al.*, 2022; de Clercq *et al.*, 2013). Learning occurs when individuals integrate new experiences with existing knowledge to form an updated understanding (Joy and Kolb, 2009). This process is a critical part of innovation, especially in complex, evolving healthcare environments. Learning orientation reflects an individual's propensity to constantly update their knowledge sets (de Clercq *et al.*, 2013). It supports navigating uncertainty and contributes directly to problem-solving and innovation outcomes. Researchers have highlighted its importance for public sector innovation (Mutonyi *et al.*, 2020) and in organisational contexts (Alerasoul *et al.*, 2022). In the context of evidence-based innovation, a strong learning orientation ensures practitioners remain responsive to new data and clinical insights.

Research competence

Research competence is foundational to evidence-based innovation in healthcare (Boore and Porter, 2011; Bourke-Taylor *et al.*, 2021; Comer *et al.*, 2022). Unlike business or service innovations, healthcare innovations must be scientifically validated to ensure they are safe and effective. Research competence entails the ability to locate, appraise and apply existing evidence, as well as the skills to conduct original research (design studies, collect and analyse data, and disseminate findings) (Palmer *et al.*, 2023). For allied health professionals such as occupational therapists, research competence enables critical reflection and informed clinical decision-making, ensuring interventions are grounded in the scientific evidence (Cordier and Wilkes-Gillan, 2021). It also supports the design and evaluation of innovations in practice. Therefore, university curricula need to develop these capabilities to meet accreditation and professional expectations.

In the United Kingdom, occupational therapists report aspirations for both practitioners and students to engage in research (Hackett *et al.*, 2024). However, gaps in research competence among allied professionals remain a barrier to integrating research evidence into practice (Comer *et al.*, 2022). Addressing these gaps can enhance professional confidence, career sustainability and employability (Bennett *et al.*, 2003).

The InventOTive intervention

This study examines the *InventOTive* intervention, embedded in a structured, double-credit capstone unit in the final year of an Australian occupational therapy honours program. Designed to enhance employability, the intervention cultivates an evidence-based innovation mindset by integrating innovation and research capabilities. Drawing from entrepreneurship theory (Covin *et al.*, 2020; Barnes and de Villiers Scheepers, 2018) and occupational therapy literature (Gill *et al.*, 2024; Hackett *et al.*, 2024; Comer *et al.*, 2022), this study evaluates its impact on students' evidence-based innovation mindset by asking the following research questions:

- (1) To what extent did students perceive changes in their evidence-based innovation mindset after participating in the *InventOTive* intervention?
- (2) How did the intervention develop this mindset?

Contributing to the healthcare employability literature (Leadbeatter *et al.*, 2023), this study positions the evidence-based innovation mindset as a multidimensional, problem-solving approach, rather than a discrete set of skills, thereby enhancing adaptability across diverse clinical settings.

Similar to Living Labs (Van Engelenhoven *et al.*, 2023), *InventOTive* engages students, universities and community partners in co-creation processes. The co-created projects were based on the community's identification of an area of need or an opportunity relevant to their organisation. This included topics such as low-cost pressure solutions for people with physical disabilities, e-sports coaching opportunities for people with disability, and a hospital-to-home transitions for adolescents with eating disorders. Unlike apprenticeship-based models (Gilbert Hunt, 2017), *InventOTive* embeds student learning in academic and community contexts outside traditional work-integrated learning placements. It is one of the first occupational therapy units to explicitly focus on cultivating both innovation capabilities and evidence-based decision-making by developing applied research skills.

Using PjBL pedagogy, students collaborated in small groups to address real-world problems working with external partners (Granado-Alcon *et al.*, 2020; Guo *et al.*, 2020). Over 13 weeks, students progressed through six phases: exploration, planning, data collection, analysis, implementation and iteration. The outcomes were presented at a university conference. Weekly four-hour workshops supported innovation, research and project management skill development, complemented by additional four-hour tutor-supported sessions for guided project work (see Figure 2). Student groups met regularly with external stakeholders to facilitate co-creation.

PjBL promotes sustained inquiry, collaboration and critical thinking (Krajcik and Shin, 2014; Larmer *et al.*, 2015), with demonstrated benefits across higher education, including skill acquisition and knowledge integration (Guo *et al.*, 2020). Students work on projects and introduce innovative solutions to address challenges such as picky eating, technology skills for older adults, and support for neurodiverse families. Outcomes are presented to the wider community and shared via a website (<https://otinnovationsunisc.weebly.com>) reinforcing practical application and impact.

Methods

This study utilised evaluation research, incorporating pre-and post-surveys and interviews (Powell, 2006) to examine *InventOTive*'s impact on students' development of an evidence-based innovation mindset. Evaluation research is the systematic assessment of a program's outcomes, compared with explicit or implicit standards, to improve the program (Weiss, 1998). Evaluation research is commonly used to assess educational programs, such as Van Engelenhoven *et al.*'s (2023) evaluation of Living Labs. Over two years, the current study collected and analysed quantitative and qualitative data from occupational therapy students

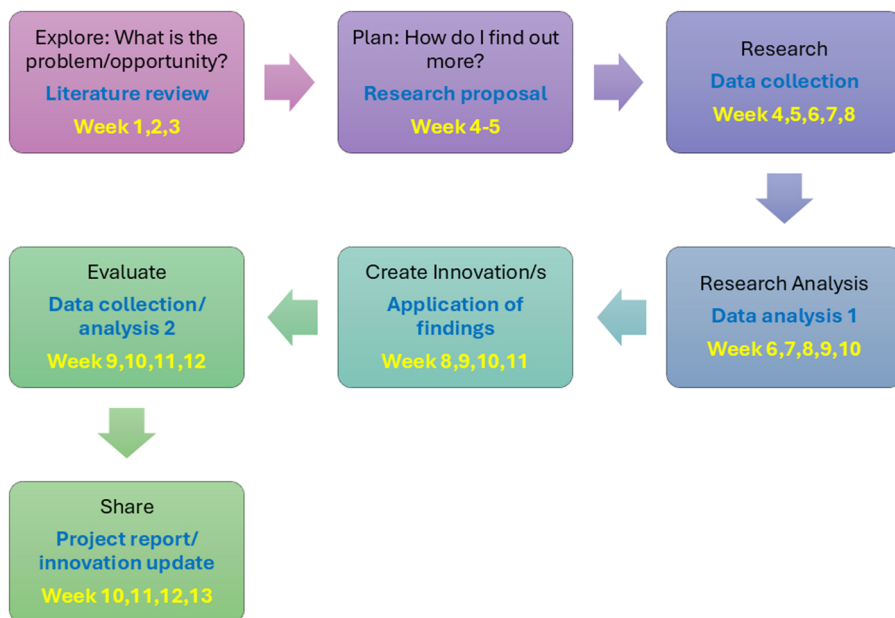


Figure 2. Stages and foci of the InventOTive intervention. Source: Authors' own work

who participated in the intervention (Hanson *et al.*, 2005). The survey was pilot tested after the intervention in 2022 and then administered pre- and post-intervention in 2023 to assess changes in students' perceptions across the five mindset dimensions. Qualitative interviews conducted in 2022 and 2023 explored how students believed the intervention developed their mindset. In this way, the design provided a comprehensive understanding of both the extent and process of mindset development by triangulating quantitative and qualitative data, providing evidence of a change in students' mindsets and a nuanced understanding of students' reflection on their experiences before and after participating in *InventOTive* (Hanson *et al.*, 2005; Johnson and Turner, 2003). Using surveys and interviews provided a more holistic, rigorous evaluation (Powell, 2006).

Sample and data collection

Participants were 52 final-year students in an occupational therapy program at an Australian university. The cohort predominantly consisted of mature-aged female students in a region with above-average socio-economic disadvantage (Australian Bureau of Statistics, 2021), where health and social care are the largest employment sectors (National Institute of Economic and Industry Research, 2023). All participants engaged in the *InventOTive* intervention during 2022 or 2023. Survey data from 2022 were used to pilot the instrument, and only 2023 survey data were included in the final analysis ($n = 52$). These response rates are similar to those of other educational interventions (Romero-Rodríguez *et al.*, 2023; Van Engelenhoven *et al.*, 2023). In addition, two trained research assistants conducted interviews with 21 students (11 in 2022, 10 in 2023). Human research ethical approval (from [removed for peer review] ethics approval number A221799) was obtained, participation was voluntary, and all participants provided informed consent.

Surveys were anonymous, and no demographic data such as age or gender were collected due to the researchers' teaching roles. This approach helped to minimise perceived power

imbalances. Semi-structured interviews were conducted post-intervention by a researcher who was not involved in teaching the unit. Interviews lasted 30–50 min, were audio-recorded, transcribed verbatim and de-identified. Pseudonyms (e.g. Monty, Willow, and Tio) were assigned to each participant to enhance the authenticity of the thematic analysis and maintain confidentiality.

Survey measures

Survey measures were drawn from existing, validated scales and were pilot tested in 2022 with 41 student participants. Standardised responses enabled pre- and post-intervention comparisons (Pearlson *et al.*, 2019). Five constructs representing the evidence-based innovation mindset dimensions were assessed using established scales from the entrepreneurship literature, IEO, ISE, learning orientation, persistence and research confidence, all measured on a five-point Likert scale. The survey is available in Appendix. IEO was measured using a 10-item scale assessing innovativeness, proactiveness and risk-taking (Covin *et al.*, 2020). ISE was adapted from Chen *et al.* (2001) and included four items: identifying opportunities, creative problem-solving, creating new products, and market implementation (Items 11–14). Learning orientation was measured with four items from de Clercq *et al.* (2013) (Items 15–18); persistence was assessed using four items from Duckworth *et al.* (2007) (Items 19–22); and research confidence was measured with three perceptual items developed by the research team (Items 23–25). The reliability of each construct was assessed using Cronbach’s alpha coefficients (see Table 1).

Interview protocol

Semi-structured interviews were used to explore how the *InventOTive* intervention developed an evidence-based innovation mindset. The interview protocol questions were designed to complement the survey and gain insight into how and why participants’ innovation mindsets were influenced. It comprised three sections: introduction and warm up, innovation questions and research competence and allowed for prompting to facilitate discussion and clarification. The warm up invited general reflections on the experience such as “Please tell me about the occupational therapy innovation course in your own words”. Innovation questions explored evolving perceptions of innovation, asking questions such as “What are your thoughts about innovation now at the end of the course compared with when you started?” and “How do you feel about your ability to innovate?” The research questions probed students’ perceived research skills, including “How do you feel about research?” and “Please tell me about your research skills?” The questions were designed to elicit both cognitive and emotional responses in participants’ own words, enabling deeper insights into their experiences (Roberts, 2020). As knowledge is co-constructed, it requires active participation from participants and interviewers (see Supplementary File).

Table 1. Descriptive statistics and correlations (T1) July 2023

Variables	Mean (T1)	Standard deviation	Cronbach alpha	IEO	ISE	LO	Persistence
IEO	3.771	0.445	0.713				
ISE	3.389	0.689	0.744	0.522**			
LO	4.144	0.478	0.695	0.608**	0.371**		
Persistence	3.9660	0.590	0.745 [#]	0.591**	0.488**	0.520**	
Research confidence	3.754	0.508	0.652	0.511**	0.555**	0.461**	0.540**

Note(s): N = 56

[#] = with one item removed

Source(s): Authors’ own work

Data analysis

Survey data were analysed using IBM Statistical Package for Social Sciences Version 29.0. After evidence-based innovation mindset constructs were found to be reliable, descriptive statistics (mean and standard deviation) were calculated, and the change in mindset was compared pre- and post-intervention using the Wilcoxon signed-rank test, a nonparametric test for paired data (Rosner *et al.*, 2006).

The interviews were audio-recorded, transcribed and imported into NVivo 14 software. Interview data were coded using reflexive thematic analysis to identify patterned meanings related to the development of an innovation mindset. Reflexive thematic analysis involved initially coding with a semantic focus: “reporting explicitly stated ideas concepts meanings, experiences” (Braun *et al.*, 2016, p. 192). Each transcript was inductively coded line by line by two research team members who worked independently to identify initial semantic codes from the participants’ verbatim responses. Next, the codes and transcripts were reviewed with a latent focus, “where you code and develop analysis around more implicit ideas or concepts that underpin what is explicitly expressed” (Braun *et al.*, 2016, p. 192). This required another round of coding and recoding by a single researcher. The research team then met to iteratively review, compare and refine codes, resolving interpretive differences through discussion until a shared understanding was achieved. Themes were developed collaboratively by grouping conceptually related codes with continual reference to the data, the dimensions of an evidence-based innovation mindset, and the study’s research questions. The research team consisted of academics from occupational therapy and business, and an occupational therapy student researcher. All engaged in reflexivity and acknowledged the emerging insights regarding the effectiveness of *InventOTive*. Representative participant quotations were used to illustrate the four themes and ensure transparency in interpretation.

Results

Survey results

The descriptive statistics from the survey are presented in Table 1, showing the mean (M), standard deviation (SD), reliability (Cronbach’s alpha coefficients) and correlation analysis for the sample prior to the intervention for each of the evidence-based innovation mindset dimensions. The IEO and ISE constructs showed good reliability with values above 0.7, whereas learning orientation and research confidence had acceptable values above 0.65. The persistence scale had to be refined, and after removing item 20, the Cronbach’s alpha increased from 0.63 to 0.75. When examining the mean scores, learning orientation had the highest mean (M = 4.144) and ISE had the lowest mean prior to the intervention. The dimensions of the evidence-based innovation mindset are significantly correlated, showing evidence of the associations between the mindset dimensions.

Significant differences were evident in four of the five dimensions, with students’ IEO, ISE, persistence and research confidence showing statistically significant improvements (see Table 2). In contrast, learning orientation did not show a significant improvement; this dimension was already high prior to the intervention and was expected because the cohort was final-year occupational therapy students.

Interview findings

The interview data were thematically analysed to gain insight into 21 participants’ reflections on how the intervention developed an innovation-based mindset. Reflexive thematic analysis identified four latent reflexive themes and associated semantic sub-themes: 1) gradually building confidence as innovators and researchers through hands-on experience; 2) valuing authentic innovation, underpinned by persistence and flexible thinking; 3) recognising that research and innovation can be mutually reinforcing; and 4) capable of making an impact using

Table 2. Changes in evidence-based innovation mindset dimensions, Wilcoxon signed-rank test

Variables	Mean T1 (before)	SD T1	Mean T2 (after)	SD T2	Difference in mean	T-value
IEO	3.771	0.446	3.981	0.482	−0.210	−3.196**
ISE	3.389	0.689	3.952	0.507	−0.563	−5.290**
LO	4.144	0.478	4.178	0.444	−0.034	−0.503
Persistence	3.966	0.590	4.164	0.456	−0.197	−2.382*
Research confidence	3.754	0.508	4.092	0.479	−0.338	−4.599**

Note(s): * $p < 0.05$; ** $p < 0.01$
Source(s): Authors' own work

innovation and research skills (see Table 3). Each theme is described in the following subsections and supported by illustrative quotes.

Theme 1: Gradually building confidence as innovators and researchers through hands-on experience

The first latent theme encompasses the dynamic process of developing participants' confidence as innovators and researchers through hands-on learning experiences. This was supported by four semantic themes: changing perceptions and attitudes, experiential knowledge of innovation, experiencing challenges and doubts, and developing emergent self-efficacy and confidence.

Participants consistently indicated that their perceptions and attitudes towards innovation and research had changed, with many expressing their surprise at the change. Sharon explained:

I was a bit daunted by the whole project innovation because I just couldn't foresee myself actually ... coming up with something new and innovative, but I've gained confidence from actually doing it, ... maybe you are more creative than you initially gave yourself credit for.

Table 3. Latent and semantic themes and sub-themes of how the intervention influenced participants' evidence-based mindsets

Latent implicit themes	Semantic stated themes
1) Gradually building confidence as innovators and researchers through hands-on experience	Changing perceptions and attitudes Experiential knowledge of innovation Experiencing challenges and doubt Emerging sense of self efficacy and confidence
2) Valuing authentic innovation underpinned by persistence and flexible thinking	Real world innovation Creativity and flexible thinking Persistence
3) Recognising that research and innovation can be mutually reinforcing	Innovating needs research Real world research Motivated to learn research skills
4) Capable of making impact using innovation and research skills	Future innovation Future evidence-based practice Future impact

Source(s): Authors' own work

Participant reflections demonstrated a growing awareness of innovation as a distinct and valued capability. For example, Tio noted:

It's really important to know the processes of creating an innovation. I think it's something that we (occupational therapists) are unknown for and should be known for. It gives us an edge ... don't be generic and try and really think ... we always think outside the square.

Similarly, participants also expressed *"a newfound respect for research"* (Zed). Some described an initial disconnect between research and their profession: *"initially, I would have thought, research was for academics"* (Lola). Whereas Sharon noted, *"it's just enhanced my appreciation for research"*. These observations indicate the insights they gained and how their attitudes towards innovation and research changed as they overcame their initial discomfort and grew in confidence.

Developing an evidence-based innovation mindset required experiential knowledge of innovation, which participants gained through the intervention described as *"exciting"* and enjoyable: *"This is something that's so much fun"* (Amelia). As Willow explained:

It's really important to know about what [innovation] is and how you can do it. And the benefits of it ... to know why innovation is good personally to learn, but then also why it's good to be able to create it for other people.

Developing innovative solutions for a target community group through the intervention confirmed the value of experiential learning in building participants' confidence.

The learning experience included challenges and doubts; participants acknowledged feeling *"frustration," "stress"* and *"initial overwhelm"* when trying to innovate. They were tested by the research required, which was *"difficult"* and *"scary"*. Many highlighted the challenges that came with the experience; for example, Sharon reflected that *"it pushed me to levels (that) I didn't think that I could actually get to. It forced me to get out of my comfort zone. It forced me to learn new things. It challenged me."* These statements demonstrate that although experiential learning can be challenging, the process develops participants' self-reliance and confidence.

An emerging sense of self-efficacy and confidence was evident in students' reflections on their capabilities: *"I think, 'Oh my God, I could never do that.' But again, ... potentially could be something I could do"* (Minty). While participants acknowledged their own growth and self-efficacy, it was emergent, and they still experienced self-doubt as both researchers and innovators. Confidence fluctuated over time, with some noting that they still had more to learn but felt equipped with foundational skills. For example, Penny acknowledged that she was *"more confident now ... but I still feel like I have a long way to go. But I have the foundations ... to move forward more confidently and now know what I'm doing."* These statements highlight that students' confidence as emerging innovators and researchers developed incrementally through experiential learning and reflection, while working on authentic problems.

Theme 2: Valuing authentic innovation, underpinned by persistence and flexible thinking

The second latent theme identified that participants valued authentic innovation as an outcome of problem-based learning. Three related semantic themes are innovations developed in real-world contexts, innovations that require flexible thinking, and creativity underpinned by persistence.

Participants highly valued real-world innovation, as projects centred on opportunities that provided authentic learning contexts where they could *"actually make a difference"* (Liz) through their novel solutions, which contributed to improvement and change. The expectation to create an innovation was motivating: *"There is like tangible outcomes for this, you know, it's going to somebody, it's actually going to be utilised. Hopefully, it needs to actually be useful"* (Theodore). This sense of purpose, provided by the relevance and meaningfulness of

the innovations developed for clients, highlighted the value of authenticity that problem-based learning provides.

Participants valued innovation underpinned by creativity and flexible thinking. They described flexibility and creativity as having to “*think outside of the box*” (Sharon), and recognised that innovation was “*constantly changing*” (Louise). Consequently, some also highlighted the importance of taking risks in the innovation process; for example, Amelia explained that “*projects ... (that) were brave, and they were bold ... really, paid off*”. Innovation was seen as requiring ongoing flexibility and creativity, in contrast to structured research protocols governing academic research that are prescriptive in design, “*because I’m used to having a linear process and something already been laid out ... there is no linear process (in innovation)*” (Louise). These experiences illustrate how creativity and flexible thinking enabled students to engage in authentic innovation.

Persistence also emerged as connected to a solution-focused approach, with participants acknowledging that innovation requires sustained effort. For example, Sharon described the iterative nature of the innovation process as “*a lot of trial and error ... that wasn’t an easy process, [there] actually was a lot of back and forward*”. Participants reflected on the time and effort required to bring an idea to fruition. Ava noted that she:

Didn’t realise how difficult it can be to reach ... an end innovation goal, ... It’s quite a time-consuming process ... (it is) important going through this procedure is to make sure it’s evidence-based to have it actionable within a workplace.

Isla similarly reflected that “*future students [should] just ... stick with it. And to ... see the importance of it as you go along*”. Despite the challenges, participants found the experience rewarding. They recognised the value of persistence and effort “*because the more time you put into something, you have an appreciation for that outcome, because you can see all of that work that you’ve put in*” (Sharon). These reflections demonstrate that sustained persistence was needed, as authentic innovation emerged from an iterative and demanding process.

Theme 3: Recognising that research and innovation can be mutually reinforcing

The third latent theme showed that participants considered innovation and research to be intertwined and mutually reinforcing in this allied health education setting. The supporting semantic themes included innovation needs research, real-world research, and the intervention motivated participants to learn research skills.

Innovation needs research because identifying novel opportunities relies on understanding the existing evidence and literature: “*Innovation requires lots of background research. That’s actually probably something I didn’t think of early on, is how much research and evidence you need to back up your innovation*” (Matilda). Creating innovations then provided opportunities to apply research methods to develop, evaluate and improve them:

It’s all about, in my opinion, creating a project that is based off research ... , you’re still consistently using all research skills, whether that be creating the literature review, data collection, creating a report ... to then still create a final product (innovation) that is based off all research skills (Willow).

These reflections illustrate how research evidence underpins the innovation process and demonstrates the reinforcing relationship between the two.

Real-world research was viewed as essential to producing meaningful innovations; participants emphasised that quality innovation in allied health must be grounded in robust research. Sharon noted, “*If you’re going to create something, it needs to be evidenced, there needs to be strong evidence behind it.*” Zed concurred, “*I can’t imagine innovation without research*”. Thus, real-world research strengthened the impact of participants’ innovation, showing the interconnected nature of research and innovation for allied health professionals.

The experiential innovation process was motivating for learning research skills because seeking to innovate provided opportunities to conduct research that was relevant and relatable rather than theoretical or academic. As Charlotte expressed:

You're doing research, . . . you're given this responsibility, and it's, it's going to create a real impact. . . . This is you're conducting research, that's very real. It's going to be put out in the world, you're working with real stakeholders, you're interviewing real people, you're creating real surveys. It's very, it's very real world.

After completing the intervention and unit, participants described innovation and research as integrated in the PjBL process, demonstrating the value of experiential learning and the integrated nature of research and innovation.

Theme 4: Capable of making an impact using innovation and research skills

The final theme highlights participants' future career aspirations as graduate allied health professionals and practising occupational therapists, capable of making a real-world impact by drawing on the innovation and research competencies developed through the PjBL intervention. Participants described their career aspirations in three semantic themes: future innovation, future evidence-based practice, and future impact as an allied health professional.

Future innovation was described as an ongoing professional commitment in their careers. Participants anticipated continuing to think creatively and to develop and implement new solutions in practice. For example, Sharon asserted, "*In my future practice, I am going to have to continue to be innovative and think outside the box*", and Isla noted, "*I feel like innovation is something that we will continue to do when we're out working*". These reflections show that the mindset participants developed was not confined to the unit they completed; rather, it formed part of their capabilities for their future careers.

Future evidence-based practice was also viewed as essential, as participants anticipated seeking, applying and conducting research to inform their professional decisions. They recognised the value of research as relevant for clinical practice as occupational therapists. Skye expressed interest in "*conducting research . . . within the work environment*", and Isla acknowledged that her understanding of research being "*a university sort of concept*" had shifted to recognising that it "*does link to practice very much . . . as an emerging professional and heading into practice*". These accounts demonstrate the participants' readiness to integrate research into ongoing practice-based innovation.

The future impact they could contribute to their careers was articulated as a confident belief in their ability to meaningfully affect their professions through their innovation and research competencies. They expressed a sense of responsibility to influence practice and meaningfully contribute to the occupational therapy profession. Minty described this aspiration as enhancing the profession: "*(This) is going to enhance . . . occupational therapy . . . that's really it. Just something that will help to grow the profession.*" Participants' reflections revealed an emerging professional identity grounded in their contributions throughout their careers.

Overall, the reflexive thematic analysis provided insight into how the intervention developed an evidence-based innovation mindset. The themes demonstrate the value of experiential, hands-on innovation in developing this mindset, enabling participants to build confidence, persist through setbacks, and remain flexible. As allied health professionals, this involved integrating research into innovation. Developing the capabilities to enact the evidence-based innovation mindset was seen as integral to their career aspirations as allied health professionals.

Discussion

This study defines the dimensions of an evidence-based innovation mindset and evaluates the educational experiences of allied health students who participated in the *InventOTive* intervention, using an evaluation design. It contributes to the literature in three ways. First, we conceptualised the evidence-based innovation mindset for healthcare by integrating relevant

concepts from the entrepreneurship and occupational therapy literature as the theoretical foundation. Our work extends the entrepreneurship education literature (Maritz *et al.*, 2019; de Villiers Scheepers *et al.*, 2018) and clarifies its relevance to allied health evidence-based research (Bourke-Taylor *et al.*, 2021). Second, we evaluated how a PjBL intervention affected students' innovation and research capabilities before and after the intervention. The study used survey and interview data to capture both the breadth and depth of their experiences and reflections, extending PjBL evaluation studies (Guo *et al.*, 2020; Granado-Alcon *et al.*, 2020). Finally, our findings offer pedagogical implications for healthcare educators on redesigning healthcare curricula to cultivate this mindset, addressing the calls of Sharma *et al.* (2022) and Lim *et al.* (2024), thereby enhancing clinicians' ability to innovate within existing organisations or independent practice in dynamic healthcare environments.

The evidence-based innovation mindset delineates five dimensions, including both innovation and research capabilities, theoretically underpinned by integrating entrepreneurship education literature (Covin *et al.*, 2020; Van Gelderen, 2012) and allied health evidence-based research (Bourke-Taylor *et al.*, 2021; Du Toit *et al.*, 2010; Hackett *et al.*, 2024). Entrepreneurship education scholarship has examined innovation, agency and opportunity-driven behaviour (Maritz *et al.*, 2022), and the allied health literature has emphasised evidence-based practice (Palmer *et al.*, 2023); however, these literatures have developed in parallel and not provided an integrated framework for healthcare professionals. This is noteworthy, given the importance of innovation in healthcare (Sreenivasan and Suresh, 2022) and the lack of a unified theoretical understanding (Lim *et al.*, 2024) of what constitutes this mindset. By integrating these literatures, this study contributes a coherent foundation for this mindset and its dimensions to regulate allied health professions. The conceptual foundation of the evidence-based innovation mindset guides undergraduate and postgraduate healthcare educators to cultivate an adaptive mindset. It enables clinicians to respond to patient and client needs and policy shifts, while maintaining professional standards (Barclay *et al.*, 2020; Occupational Therapy Board Australia, 2018). This is a novel area of exploration, as innovation capabilities have not been explicitly identified as measurable capacities in allied health accreditation standards.

The findings showed that the intervention cultivated several dimensions of the evidence-based innovation mindset. The survey data indicated significant increases in IEO, ISE, persistence and research confidence, reflecting changes in four of the five dimensions. The thematic analysis supported these findings, with participants highlighting experiential PjBL learning as integral to developing an evidence-based innovation mindset, extending the work of Gilbert Hunt (2017). Further, students valued authentic innovation underpinned by persistence and flexible thinking. This is linked to increased IEO, which comprises innovativeness, risk-taking and proactiveness (Covin *et al.*, 2020). Hands-on learning enhanced their confidence in navigating the innovation process, despite doubts and challenges and helped them recognise innovation as an iterative and dynamic process.

Participants noted a shift in their attitudes towards research, evolving from an abstract, academic understanding to recognising its relevance for clinical reasoning and evidence-informed decision-making. Although no significance was found in the learning orientation dimension (already high among fourth-year students), the thematic analysis revealed that the intervention deepened their conviction regarding the value of integrating innovation and research capabilities in their future careers. Our findings align with Hackett *et al.* (2024) in advocating for research engagement in curricula and addressing practical research competency gaps among health professionals (Comer *et al.*, 2022; Palmer *et al.*, 2023).

Notably, this paper addresses a gap in the literature. Capstone units typically focus on either research or innovation capabilities, while our findings show that these capabilities are intertwined and can be developed simultaneously through curriculum design. These findings address Sharma *et al.*'s (2022) call for healthcare curricula that equip clinicians to lead innovations and extend the debate on experiential learning's role in developing future-ready graduates through hands-on learning in curricular interventions within professional

communities (de Villiers Scheepers *et al.*, 2018; Van Engelenhoven *et al.*, 2023). Although prior work has focused on the value of problem-based and work-integrated learning for employability (Jackson and Cook, 2023; Leadbeatter *et al.*, 2023), less attention has been paid to regulated healthcare professions. By demonstrating measurable shifts in entrepreneurial orientation, self-efficacy, persistence and research confidence through structured PjBL, this study contributes to graduate employability scholarship (Jackson and Cook, 2023). Specifically, it conceptualises an evidence-based innovation mindset as a coherent and assessable graduate capability within allied health education.

Finally, our findings have pedagogical implications for healthcare educators, who should redesign healthcare curricula to address the calls of Lim *et al.* (2024) and Sharma *et al.* (2022). This can be achieved in three ways. First, educators should incorporate experiential PjBL that combines innovation and research learning outcomes to enhance students' confidence and enable them to iteratively apply the innovation process, informed by research evidence. Prior studies confirm the value of experiential PjBL in capstone units (Gill *et al.*, 2024; Thew *et al.*, 2018). Second, innovation challenges should be anchored in authentic, community-centred problems, with educators actively partnering with these organisations. Working on real-world problems enhances authenticity and supports meaningful learning, aligned to contemporary care models (Barclay *et al.*, 2020). This authenticity deepens learning and strengthens students' career aspirations as allied health professionals. Third, curricula should embrace designs that embed uncertain outcomes and opportunity for student agency, which in turn requires persistence and flexible problem-solving because of the non-linear nature of innovation. Our identified themes show that students recognise that innovation requires sustained effort, iterative refinement and adaptation as new data and evidence emerge. These adaptive capabilities are not typically embedded in traditional healthcare curricula; therefore, educators should design learning experiences that cultivate these dimensions of the evidence-based innovation mindset. We call on healthcare educators to intentionally cultivate the dimensions of the evidence-based innovation mindset to prepare graduates for the uncertainty and dynamism of the healthcare labour market. Both innovation and research capabilities should be integrated and explicitly recognised as graduate capabilities for allied health professionals.

Conclusion and future research

An evidence-based innovation mindset can be cultivated through capstone units that intentionally integrate innovation and research capabilities, enabling allied health graduates to introduce innovations and navigate the dynamic labour market with greater confidence. Healthcare curricula that embed experiential, problem-driven PjBL, in which students actively engage with community stakeholders and iteratively research, develop and evaluate innovative solutions, contribute to cultivating this mindset. Such approaches offer mutual benefits, as students gain authentic learning experiences that strengthen their career aspirations and sense of meaningful impact, while community stakeholders receive cost-neutral, evidence-based innovation that addresses real care needs.

This study is not without its limitations, as a small sample was used to assess the intervention detailed in this paper. This intervention offers only one approach to cultivating an evidence-based innovation mindset and aims to provide insights for healthcare educators on redesigning curricula. The proposed mindset and intervention need to be evaluated across diverse educational and cultural settings to assess their effectiveness and broader value. By targeting the core dimensions of the evidence-based innovation mindset, similar interventions could be adapted to other settings. However, the study is further limited by its context, as it was tested in a specific cultural setting (a low socio-economic status region) where university–community engagement is strong. Further, the intervention is resource-intensive, requiring substantial staff involvement, which may limit its transferability. Finally, students were

interviewed one to three months after completing the capstone, and a longitudinal study could offer a more nuanced understanding of the longer-term career impacts of the intervention.

Future research can extend this work by redesigning healthcare curricula, exploring the replicability of this intervention or assessing whether similar mindset outcomes can be achieved through alternative formats or professional development activities. Investigating variations across disciplines, cultural settings and curriculum structures would further support the value of the evidence-based innovation mindset.

The evidence-based innovation mindset has several theoretical and practical implications. Theoretically, this study contributes to the healthcare employability literature (Leadbeatter *et al.*, 2023) by demonstrating that an evidence-based innovation mindset can be developed through structured experiential learning and that innovation and research capabilities should be integrated within one unit. Drawing from entrepreneurship and social innovation frameworks, it highlights their relevance in allied health contexts. Practically, this study offers implications for students, educators and the healthcare workforce. For students, it shows the value of a hands-on intervention to improve creative problem-solving and innovation capabilities for their clients and the community, underpinned by research skills. For educators, it offers pedagogical implications and the need to redesign healthcare curricula to cultivate an evidence-based innovation mindset. For the existing healthcare workforce, such as senior clinicians and managers, the findings accentuate the need to support innovative graduates who can contribute in novel ways and enhance service delivery. Initiatives like the *Queensland Health Research Strategy 2023* emphasise the importance of cultivating workplace environments that support innovation and evidence-based practice (Queensland Health, 2024). This support can help retain early-stage clinicians. Further, the study points to the importance of also developing ongoing professional development initiatives to cultivate this mindset among the existing workforce.

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Appendix
Survey instrument

The following questions explore your personal attitudes and behaviours. There are no correct answers. Please answer by choosing your best fit for each item. To what extent do you agree or disagree with the following statements, where 1 indicates strongly disagree, and 5 indicates strongly agree.

Table A1. Items used in survey

Survey items
1. I'm comfortable with renewal and change
2. I quickly master new routines, processes and ways of working
3. When it comes to problem solving, I always search for creative solutions instead of familiar ones
4. I actively share knowledge with my team members and peers, not only when I'm asked or approached to do so
5. I am constantly looking for new ways to innovate in my studies and at work
6. I always try to find ways (and solutions) to improve clients' situations
7. I am constantly looking for ways to improve my performance on the job
8. I value new plans and ideas, even if I feel that they are unproven in practice
9. In order to be more innovative, I believe it is better to ask forgiveness, than permission in the workplace
10. I seek out professional collaborators, if needed to improve my solutions

(continued)

Table A1. Continued

Survey items

11. I am confident I can identify innovation opportunities
12. I am confident I can create new products or service offerings
13. I am confident I can creatively solve problems
14. I am confident that I can take a business concept to market.
15. I like taking on challenging tasks from which I can learn a lot
16. I look for opportunities to develop new skills and knowledge
17. I enjoy difficult tasks through which I can learn new skills
18. I believe I grow as a person when working through unexpected difficulties
19. No matter how challenging my work is, I will not give up
20. Regardless of what happens, I believe I can control my reaction to it
21. I continue to work hard on projects even when others oppose me
22. I can think of many times when I persisted with work when others quit
23. I am confident I can identify research opportunities
24. I am confident I can create new research projects and plans
25. I am confident that I can execute workplace-based research in the future

Supplementary material

The supplementary material for this article can be found online.

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