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Students' Voices: Insights into Capstone Projects in Complementary Medicine Higher Education

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Abstract Postgraduate research training plays a pivotal role in preparing complementary medicine graduates for evidence-based professional practice. Capstone projects serve as a critical bridge between academic learning and professional practice. While capstone's pedagogical value is well-recognised, limited research captures students' perspectives on the capstone process in complementary medicine education contexts. The conceptual framework anchored in this study was the Invitational Education and the Technological Pedagogical Content Knowledge model. A qualitative descriptive case study design was adopted. Participants completed reflective diaries containing open-ended prompts about their capstone experiences. Responses were analysed using Braun and Clarke's six-step thematic analysis. Analysis revealed three overarching themes: (1) Academic and Research Skill Development; (2) Time, Life, and Workload Management, and (3) Support Systems and Personal Transformation. Students' accounts reveal the capstone project as both a challenging and transformative component of postgraduate health sciences education. The findings emphasise the importance of structured support systems, clear guidance, and pedagogical approaches that foster autonomy and maintain high academic standards. These insights can inform curriculum refinements and supervision strategies to optimise student learning and professional development.

Keywords: capstone projects; health sciences; research; higher education

1. Introduction

Postgraduate research training plays a pivotal role in preparing complementary medicine graduates for evidence-based professional practice, where traditional knowledge systems intersect with modern scientific inquiry. Within this context, capstone projects have emerged as a signature pedagogical approach, offering students an opportunity to integrate theoretical knowledge, clinical skills, and research competencies through sustained, project-based learning. Within this context, Tenhunen et al. (2023) and Yoo and Kang (2024) report that capstone

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projects have demonstrated their effectiveness in fostering critical thinking, reflective practice, and readiness of graduates for complex professional roles. In South Africa, however, postgraduate research in complementary medicine remains an emerging field, with few structured programmes designed to develop both scholarly and clinical capabilities in an integrated manner (Razlog & Hu, 2024).

The Master of Health Sciences in Complementary Medicine (MHScCM) at the University of Johannesburg (UJ) represents a distinctive model in this regard. Its capstone project, spanning two years, incorporates sequential stages of proposal development, literature review, scientific opinion-editorial writing, action research, and a final portfolio with oral defence. This design aligns with international best practice while addressing the contextual realities of the South African higher education landscape (Razlog & Hu, 2024).

Despite its pedagogical promise, the capstone process is not without challenges. Previous studies in health sciences education have identified barriers such as limited research preparedness, competing life demands, and inconsistent supervisory support (Hu, 2024; Maree, 2020; Shurin et al., 2023). Yet, little is known about how these dynamics unfold in postgraduate complementary medicine programmes, particularly in Africa, and how they may be mediated by intentional curriculum design and supportive learning environments. In this study, the authors asked the research question: ""*What insights into capstone projects in complementary medicine higher education emerge from student perspectives*?"

This study addresses that gap by exploring students' lived experiences of the MHScCM capstone project through the dual lenses of the Technological Pedagogical Content Knowledge (TPACK) model (Mishra & Koehler, 2006) and Invitational Education (IE) framework (Purkey & Stanley, 1991). By integrating these perspectives, the research not only examines the development of research competence but also considers how the educational climate, supervisory relationships, and technological integration shape postgraduate learning outcomes. The findings aim to inform curriculum refinement, enhance supervisory practice, and contribute to broader discussions on postgraduate research training in complementary medicine.

2. Literature Review

2.1 Understanding Capstone Projects in Complementary Medicine Higher Education

Capstone projects refer to a project-based capstone approach typically represents a culmination of students' studies and is one of the last milestones before graduation (Tenhunen et al., 2023). These projects usually involve students engaging in world-of-work scenarios to address related problems and seek new solutions. As such, it synthesises and consolidates acquired knowledge through a final, comprehensive project (Elwell et al., 2021). Within the health sciences, capstone projects are widely regarded as highly relevant to professional practice, offering substantial benefits for students' career readiness and personal growth (Razlog & Hu, 2024). This view concurs with Yoo and Kang (2024) who believe

that this approach promotes a deeper understanding and appreciation of future professional roles by encouraging introspection, reflective practice, and advanced application of knowledge. In a similar vein, Soares et al. (2024) articulate that capstones also facilitate the internalisation of students' educational journeys, particularly through the lens of medical humanities, allowing them to refine their emerging professional identities.

Project-based capstone significantly enhances the students' learning experiences, fostering readiness for clinical practice and enhancing their overall professional competence (Hu, 2024). Furthermore, the projects often involve original research, which helps students develop critical research skills and the ability to conduct independent studies (Puglisi et al., 2018). As capstone projects simulate real-world challenges, students apply their academic knowledge in practical settings, preparing them for their health-related professional roles (Soares et al., 2024).

In the MHScCM programme within the Department of Complementary Medicine (DoCM) at the UJ, the capstone project serves as a compulsory research component (DoCM, 2022). The process begins with the development of a capstone proposal, followed by a narrative literature review and the preparation of a scientific opinion–editorial article on the chosen topic. The fourth stage centres on action-based research activities, incorporating an elective element such as laboratory observation, questionnaire development, regulatory review, healthcare-related enquiry, or clinical case reporting. The project culminates in the submission of a comprehensive portfolio and an oral defence (DoCM, 2025). This design aligns closely with Purkey and Stanley's Five Powerful Ps framework (1991):

- Purpose – addressing real-world research and clinical challenges;
- Persistence – sustained engagement with iterative academic and practical tasks;
- Power – student choice within elective action-research activities;
- Passion – intrinsic motivation through personalised inquiry;
- Playfulness – creativity in research design and dissemination.

Kolb's Experiential Learning Theory (ELT) further frames the UJ capstone, highlighting four cyclical stages: concrete experience, reflective observation, abstract conceptualisation, and active experimentation, all evident in the programme's structure (Kolb, 1984; Mechouat, 2024). Table 1 illustrates the alignment between Kolb's model and the MHScCM capstone stages. This approach mirrors international best practice, as seen in competency-based global health capstones and medical student transition courses (Anderson et al., 2020; Chamberlain et al., 2020). The longitudinal, student-centred design supports sustained inquiry, authentic assessment, and personal-professional integration over the two-year period (DoCM, 2025).

Table 1: Alignment of Kolb's Experiential Learning Cycle with MHScCM Capstone Stages at UJ

Kolb's Learning Stage	Description	Corresponding Capstone Stage (UJ MHScCM)
Concrete Experience	Active involvement in a new experience or situation.	Action-based research activities (e.g., clinical observations, regulatory reviews, case reporting, or stakeholder engagement).
Reflective Observation	Reflecting on the experience from multiple perspectives.	Scientific opinion-editorial article writing and final portfolio compilation, including reflections on process and outcomes.
Abstract Conceptualization	Integrating new insights with existing knowledge to form new concepts or ideas.	Narrative literature review and theoretical framing of the capstone topic.
Active Experimentation	Applying new ideas to real-world situations to test hypotheses and solve problems.	Capstone proposal development and implementation of elective research activities.

2.2 Theoretical Foundations of Capstone Projects

Learning theories provide a foundation for designing effective clinical teaching strategies, materials, and activities. When applied to capstone projects, they promote engaging, interactive, and student-centred learning environments (Munguiko et al., 2025). In particular, constructivist and experiential learning theories underpin the pedagogical design of many capstone models (Costa, 2015). Constructivist learning theory postulates that knowledge is actively constructed by individuals based on their previous experiences and interactions (Tafrova-Grigorova, 2016; Thampinathan, 2022).

In complementary medicine education, a constructivist approach allows students to interact with peers, mentors, and practical tasks to co-construct meaning, facilitating deeper understanding of complex clinical content (Munguiko et al., 2025). Students actively engage with their peers, teachers, and hands-on activities to construct new knowledge (Tafrova-Grigorova, 2016). The constructivist approach can help students better understand and assess educational content, especially in clinical settings (Thampinathan, 2022).

Experiential learning, in contrast, involves active participation and analysis of experiences. It is also widely used in health science programmes (Van Wart et al., 2020; Grace et al., 2017). In their study, Ge et al. (2025) are of the view that experiential learning has been found to enhance medical students' understanding of social determinants of health and foster growth in cognition, emotion, and social responsibility. Van de Water et al. (2024) claim that experiential learning enriches the classroom experience for health sciences students with opportunities to apply public health and biological science concepts in real-world contexts. This approach enhances cultural appreciation, promoting effective community

engagement and allowing students to realise their values and purpose as whole persons.

2.3 Barriers in Capstone Projects

Capstone projects have become an increasingly important component in preparing complementary medicine graduates for professional practice. However, their implementation in many African higher education institutions is often constrained by a range of challenges (Razlog & Hu, 2024). These can be broadly categorised into issues relating to project conceptualisation, supervision and faculty capacity, team collaboration, and research dissemination skills.

One recurring difficulty lies in the initial conceptualisation of research questions that are both academically rigorous and contextually feasible. Many students struggle to identify topics that align with disciplinary standards while remaining practical within their institutional constraints (Maree, 2020; Yasuda, 2017). Formulating questions that are methodologically sound, ethically compliant, and achievable within limited timeframes and infrastructural resources presents an additional layer of complexity (Shurin et al., 2023).

Supervision challenges also feature prominently. Academic staff often contend with inconsistent expectations and assessment practices, particularly when multiple supervisors are involved (Parker et al., 2019). A lack of structured communication and limited experience in managing collaborative projects can exacerbate delays and, in some cases, result in incomplete work (Gamil & Rahman, 2021). Furthermore, as capstone projects become increasingly complex, they may require expertise that extends beyond the capacity of a single supervisor (Topping & Murphy, 2022).

While collaborative supervision models could address this gap, they are not always feasible, and some supervisors may lack the preparation or confidence to guide capstone projects effectively (Van de Water et al., 2024). Disparities between supervisor and student expectations, where supervisors may prioritise autonomy while students prefer more hands-on guidance, can further impede progress and cause dissatisfaction (Vogel et al., 2009; Cota et al., 2024).

Another barrier lies in the final stages of the project, particularly dissemination. Many students are underprepared for the demands of academic writing, delivering presentations to interprofessional audiences, or producing manuscripts for publication. Communicating findings in a manner that is both academically robust and accessible to non-specialist audiences remains a persistent challenge (Downey, 2018; Maree, 2020). Responding constructively to supervisor or peer-review feedback is also a skill that students often find unfamiliar and anxiety-inducing (Yin, 2018). Collectively, these barriers highlight the need for targeted capacity-building interventions, both for students and supervisors, to ensure that capstone projects fulfil their potential as transformative learning experiences in health sciences education.

3. Conceptual Framework

This study is situated within the integration of two complementary theoretical perspectives: Invitational Education (IE) and the Technological Pedagogical Content Knowledge (TPCK) model, which together provide a multidimensional lens for enhancing teaching and learning in higher education. This conceptual framework is particularly relevant to the context of health sciences and professional training programmes, where both the learning environment and the pedagogical approach play a decisive role in shaping student outcomes. While IE underscores the importance of cultivating a supportive, inclusive, and intentionally positive educational climate, the TPCK model focuses on the effective integration of pedagogy, content, and technology. Their convergence offers a robust foundation for advancing curriculum design, instructional practice, and student engagement.

The IE model, developed by Purkey and Stanley (1991), presents a humanistic and democratic approach to teaching, grounded in the belief that all individuals are capable, responsible, and worthy of being invited to learn and grow. This philosophy is operationalised through the Five Powerful Ps: People, Places, Policies, Programmes, and Processes, which collectively shape the educational ecosystem. People refers to both teaching and non-teaching staff, whose attitudes, values, and interactions define the institutional culture. Places encompass the physical, virtual, and emotional environments in which learning occurs, from classrooms and laboratories to clinics and online platforms, all of which influence engagement and belonging.

Policies, both formal and informal, frame the structural and behavioural norms governing practice, including institutional regulations, curriculum frameworks, and codes of conduct. Programmes represent the curriculum content and learning experiences designed to prepare students for professional practice, while Processes describe the ways in which these domains are enacted i.e., how people collaborate, how spaces are used, how policies are implemented, and how programmes are delivered and assessed.

Purkey and Novak's (2015) starfish metaphor captures the iterative and intentional application of these domains: just as a starfish steadily uses each arm to open an oyster, educators can apply the Five Ps with persistence and purpose to address institutional and pedagogical challenges (see Figure 1). In the context of the programme at the UJ, this framework has guided initiatives such as the creation of the teaching clinics, aligning environmental improvements with curriculum innovation and student engagement.

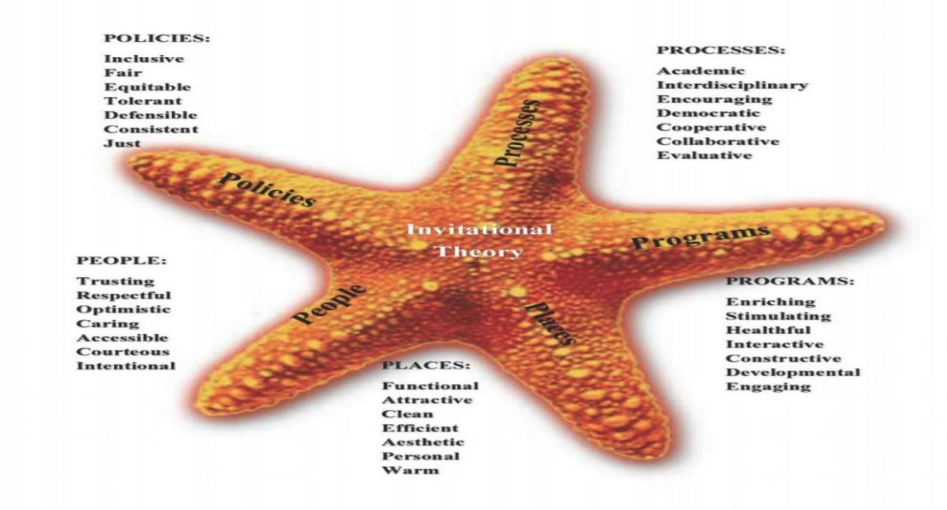

Figure 1: The elements of the 5Ps: From invitationaleducation.org

Complementing this environmental and relational focus, the TPCK model, originally conceptualised by Shulman (1986) and expanded by Mishra and Koehler (2006), addresses the instructional core of teaching. It posits that effective teaching emerges at the intersection of three forms of knowledge: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). This integration is particularly critical in preparing health sciences graduates for the demands of 21st-century practice, where digital literacy, interdisciplinary thinking, and adaptability are indispensable.

Guided by TPCK, the programme has adopted blended and hybrid learning strategies, enhanced formative assessment through digital platforms, and fostered collaborative learning environments that simulate real-world healthcare contexts. The model also promotes reflective teaching, prompting educators to critically evaluate not only what is taught, but also how and why it is taught; ensuring that content delivery is culturally sensitive, pedagogically sound, and technologically relevant.

When viewed together, IE and TPCK create a synergistic conceptual framework in which the former provides the environmental and relational context for learning. Moreover, the TPCK model ensures the strategic integration of knowledge domains and technology to optimise learning outcomes. This intersection enables the design of learning experiences that are inclusive, relevant, and transformative, aligning with broader goals of curriculum reform, academic staff development, and quality assurance.

Accordingly, this study adopts these complementary frameworks to examine how student-centred, evidence-based, and technologically informed approaches can enhance student learning in higher education. The combined application of the Five Powerful Ps and the TPCK model ensures that both the educational environment and instructional practice are intentionally aligned to prepare graduates for the dynamic demands of professional healthcare practice.

4. Research Methodology

This study adopted a qualitative case study design situated within the interpretivist paradigm to explore students' lived experiences on the capstone projects at a public university in South Africa. A single case study was selected due to the distinctive nature of the identified educational programme, which remains rare within the South African higher education landscape (Hu et al., 2022; Zhang et al., 2025). Such an approach aligns with the established view that case studies are well-suited to examining rare, context-specific, or particularly significant phenomena (Yin, 2018; Hu, 2023). The interpretivist approach was deemed appropriate as it facilitates a deep understanding of how individuals construct meaning within authentic educational contexts (Hu & Qiu, 2025; Maree, 2020).

4.1 Sampling technique and participants

Participants were recruited through purposive sampling to ensure the inclusion of individuals capable of providing rich, relevant, and insightful data (Razlog & Hu, 2024; Venketsamy et al., 2023). Recruitment began with the placement of invitation posters on campus notice boards. To participate, students had to be enrolled in the MHScCM programme, provide voluntary informed consent, and be 18 years of age or older. Given that the module had a total enrolment of only 36 students, the available pool of participants was inherently limited. Only six students agreed to participate, and pseudonyms were assigned to protect their identities. Table 2 below illustrates participants' information.

Table 2: Participant Demographic Profile

Code	Sex	Age
Participant 1	Female	24
Participant 2	Male	27
Participant 3	Female	22
Participant 4	Male	24
Participant 5	Female	25
Participant 6	Female	23

4.2 Data collection and analysis

Ethical clearance was obtained from the university's research ethics committee in Gauteng Province (Ref. No: REC-1443-2022). Data were collected from students through reflective diaries, in which they responded to a set of open-ended questions designed to elicit detailed accounts of their experiences with the capstone project. The qualitative data obtained from the reflective diaries were analysed using the six-step thematic analysis framework described by Braun and Clarke (2006), with methodological adaptations informed by Cohen et al. (2018) and Hu (2024).

This process involved: (1) familiarisation with the data; (2) generating initial codes; (3) searching for themes; (4) reviewing themes; (5) defining and naming themes; and (6) producing the report. To ensure the trustworthiness of this study, member checking, and audit trails were implemented (Venketsamy & Hu, 2022).

5. Results and Discussion

The analysis of participants' accounts revealed three interconnected themes that shaped their experiences of the capstone project: (1) Academic and Research Skill Development, (2) Time, Life, and Workload Management, and (3) Support Systems and Personal Transformation. While these themes are presented separately for analytical clarity, they are deeply intertwined, reflecting the complex realities of postgraduate research in complementary medicine.

5.1 Academic and Research Skill Development

Students entered the capstone journey with varying levels of research literacy, and for many, the academic and methodological demands were initially daunting. A recurrent challenge involved navigating the expectations of scholarly writing and understanding formal research structures, particularly for components such as the narrative review, scientific opinion-editorial, and clinical case reports. One participant captured this uncertainty, stating, "*I struggled a lot with the narrative review due to not fully understanding the expected outcome and how to properly present it*" (Participant 5). This resonates with findings from Hu and Venketsamy (2022), who note that when students transition into structured research without adequate prior training, the gap in methodological competence can hinder early progress.

The challenges were compounded in areas where the literature was sparse, such as regulatory reviews on niche health products. For instance, one student working on the medicinal plant Moringa and its regulation remarked that "*the most daunting task was reviewing studies… primarily due to the scarcity of existing research*" (Participant 1). This difficulty mirrors the issue raised by Yin (2018) that in under-researched domains, the literature review becomes a more interpretive and critical exercise, requiring advanced skills in evaluating the credibility of limited sources. Moreover, concerns about the methodological quality of existing literature were prevalent, with some students expressing frustration over unreliable or poorly designed studies: "*Many studies are published with improper or incomplete methodology that cannot be trusted*" (Participant 3). Such critical appraisal skills are essential for evidence-based complementary medicine practice (Cohen et al., 2018).

Despite these obstacles, participants frequently described significant improvement in their analytical, information literacy, and academic writing skills over the course of the project. As one noted, "*Ultimately it helped my development through sharpening my research and analysis skills*" (Participant 3). This developmental arc aligns with the constructivist view of research learning as a process of iterative refinement, where skill mastery emerges through repeated feedback and the application of increasingly complex academic tasks (Braun & Clarke, 2019). In the context of complementary medicine, these skills are critical for bridging traditional knowledge systems with scientific inquiry, ensuring that practice is both culturally relevant and empirically informed.

From a pedagogical standpoint, the findings suggest that while the capstone framework successfully fosters advanced research skills, greater emphasis on structured scaffolding in the early phases could alleviate initial difficulties.

Integrating targeted workshops on narrative synthesis, critical appraisal, and technical writing early in the programme could better prepare students for independent work later in the project cycle.

5.2 Time, Life, and Workload Management

The capstone project unfolded against the backdrop of students' multifaceted personal and professional commitments. Balancing employment, clinical placements, parenting, and academic deadlines emerged as a significant source of stress. The fixed timelines of the capstone often collided with unpredictable personal demands, as reflected in the account of a student who noted, "*I had approximately 6 months to complete the research while working a full-time job… I had to do the research while on the road, in between my lunches and breaks*" (Participant 2). Similarly, another shared, "*Time management was a big issue as I am a mom to a toddler, full-time student, and have a part-time job*" (Participant 4).

These accounts echo previous research highlighting the strain postgraduate students face in juggling academic and life responsibilities (Maree, 2020; Hu, 2023). Time pressure not only impacts the quality of work but can also diminish opportunities for reflective engagement with the research process. Missing interim deadlines with supervisors, while still meeting final submission requirements, was a common pattern. This suggests that time management challenges were most acute in the formative stages of each project phase. A further complication was the underestimation of time required for technical components such as proofreading, data analysis, and interpretation. This observation aligns with Razlog and Hu's (2024) argument that novice researchers often allocate disproportionate time to data collection, leaving insufficient time for critical synthesis and revision.

However, participants also described growth in organisational skills and discipline as an unintended but valuable outcome of these pressures. One student remarked, "*I became more disciplined and efficient, a skill that will undoubtedly benefit me in my future career*" (Participant 1). This adaptive resilience is consistent with the literature on self-regulated learning, which emphasises that time management, task prioritisation, and self-monitoring are transferable competencies that extend beyond the academic sphere (Zimmerman, 2002).

The findings suggest that while time-related pressures are an inevitable feature of intensive postgraduate research, providing students with project management tools and strategies early in the capstone process could mitigate their impact. Embedding time management workshops, offering flexible interim deadlines, and encouraging the use of digital productivity tools may help students navigate the competing demands more effectively.

5.3 Support Systems and Personal Transformation

Beyond technical skills and time management, the capstone experience was also deeply shaped by interpersonal relationships, emotional resilience, and personal growth. Supervisor guidance emerged as a pivotal factor, providing both academic direction and emotional encouragement. One participant noted, "*Working with my supervisor was really helpful… I never got discouraged when she*

corrected me, I took every comment positively" (Participant 6). The value of constructive feedback in fostering motivation and perseverance is well documented, particularly in research contexts where uncertainty and self-doubt are common (Cohen et al., 2018; Hu, 2024).

For some, supervisor interactions catalysed shifts in epistemological perspective. As one student reflected, "*It was only after my mindset shifted, and my supervisor advised me, that I became more objective*" (Participant 5). This transition from personal bias to research objectivity aligns with the critical thinking development stages outlined by Paul and Elder (2014), highlighting the role of mentorship in guiding students toward more reflective and evidence-based inquiry.

The emotional dimension of the research journey was also evident in accounts of self-doubt, distraction, and mental fatigue. One student confessed, "*I honestly feel that I have failed myself… had I given myself time and grace…*" (Participant 3), while another described experiencing mental blocks when facing unfamiliar tasks (Participant 6). Yet, these challenges often became turning points for resilience and personal transformation.

Importantly, the capstone also heightened some students' awareness of the ethical and cultural responsibilities inherent in health-related research. For example, Participant 1 described the difficulty of balancing scientific rigour with cultural sensitivity. In the authors' opinion, these are ongoing debates in complementary medicine about integrating traditional healing knowledge with modern evidence-based frameworks. Therefore, beyond individual skill development, the capstone may serve as a site for cultivating professional ethics and cultural competence (Zhang et al., 2024). The discussion here reinforces the idea that postgraduate research is not solely an intellectual endeavour but a holistic process involving cognitive, emotional, and ethical growth.

5.4 Implications for Practice

The findings have several implications for postgraduate research training in complementary medicine. First, scaffolding research skill development through structured, early-stage interventions may ease the transition into independent inquiry. Second, recognising and addressing the realities of students' competing life demands is essential; flexibility, time management support, and workload pacing could enhance both performance and well-being. Third, fostering strong supervisory relationships and embedding opportunities for reflective dialogue can amplify not only academic outcomes but also personal and professional growth. Finally, explicit integration of cultural competence and ethical reflection into the capstone process could better prepare students for the complex, pluralistic contexts in which complementary medicine is practised.

The findings of this study, when viewed through the dual lenses of the TPACK model and IE framework, provide valuable insights into the pedagogical design and experiential impact of the MHScCM capstone project. These conceptual frameworks illuminate not only the structure and progression of the project but

also the way in which it fosters both professional competence and personal growth in students.

From a TPACK perspective, the capstone project demonstrates a deliberate integration of content, pedagogy, and technology to develop advanced research capacity in complementary medicine. The project's design begins with proposal development, moving through a narrative review, scientific opinion-editorial writing, action research, and culminating in portfolio compilation and oral defence, aligning with the iterative and interconnected nature of TPACK domains. Students are required to navigate discipline-specific content knowledge (CK) in complementary medicine while employing pedagogical strategies (PK) that enhance critical inquiry and communication.

Simultaneously, they engage with technological tools (TK), such as literature databases, reference management systems, statistical software, and digital presentation platforms, not as isolated skills but as part of a blended pedagogical process. This integration supports the development of technological pedagogical content knowledge, where each element reinforces and informs the other, enabling students to approach research in complementary medicine with both rigor and adaptability.

The IE framework further deepens the understanding of the capstone's impact by emphasising the creation of an environment that intentionally invites students to realise their potential. The capstone process at the DoCM is not merely an academic requirement; it is an extended, mentored journey that affirms students' intellectual and professional worth. Through progressive milestones and personalised feedback, students experience a supportive yet challenging environment that encourages self-direction and resilience. Department engagement in guiding proposal refinement, peer review activities, and case-based action research represents an intentional effort to foster respect, trust, optimism, and care, encompassing the four foundational principles of invitational education. These principles are operationalised not only through formal supervision but also through the open, interprofessional dialogue encouraged within the programme.

The data from this study suggest that the structured yet flexible nature of the capstone promotes a dual trajectory of competence building: on one hand, students gain tangible research and clinical skills; on the other hand, they develop the confidence and professional identity necessary for leadership within the field of complementary medicine. The sequential design ensures that students can progressively integrate feedback, expand their methodological toolkit, and translate theoretical understanding into applied research outcomes. This aligns closely with TPACK's iterative knowledge development cycle and IE's emphasis on sustained, intentional invitation to learning.

By embedding technological, pedagogical, and content expertise within a relational, student-centered educational environment, the MHScCM capstone model bridges the gap between academic research and professional practice. The

findings highlight the value of conceptual frameworks that view learning not only as the mastery of discrete skills, but as the cultivation of integrated knowledge within an affirming, purpose-driven community.

6. Conclusion and Recommendations

The findings of this study highlight the transformative potential of well-structured, intentionally supported capstone projects in postgraduate complementary medicine education. Students reported significant growth in research literacy, analytical capacity, and professional confidence, despite encountering substantial challenges. When viewed through the TPACK model, the capstone emerged as a coherent integration of content, pedagogy, and technology, enabling students to navigate complex disciplinary knowledge while applying advanced research methods and digital tools. Simultaneously, the IE framework illuminated the importance of an affirming and supportive educational climate, where respectful supervision, constructive feedback, and collaborative engagement fostered both academic achievement and personal resilience.

The synergy between these frameworks appears particularly effective in addressing common barriers to postgraduate research success. By embedding skill development within a relationally rich and technologically enabled environment, the MHScCM capstone model bridges the often-noted gap between academic research and professional practice. Ultimately, the capstone was experienced not only as a final academic requirement but as a holistic professional formation process; one that shaped students' identities as competent, reflective, and ethically grounded practitioners.

Based on this study's findings and the integrated conceptual framework, the following recommendations are proposed for enhancing postgraduate capstone experiences in complementary medicine and related health sciences fields:

- Strengthen early-stage research skill development: Introduce structured workshops in the initial stages covering narrative synthesis, critical appraisal, and scholarly writing.
- Embed time and project management support: Offer training in project planning, workload pacing, and use of digital productivity tools.
- Enhance supervisory capacity and consistency: Provide professional development for supervisors in collaborative supervision models, formative feedback strategies, and culturally responsive mentorship.
- Foster a supportive and inclusive learning environment: Operationalise the Invitational Education principles of respect, trust, optimism, and care through regular reflective check-ins, peer mentoring, and accessible support channels. Encourage interprofessional dialogue and networking to broaden students' perspectives and professional connections.

7. Limitations of this Study

This research adopted a qualitative design to explore students' perspectives and experiences with capstone projects in the South African setting. While a systematic and rigorous process was maintained throughout, the inherent subjectivity of the interpretivist paradigm is acknowledged as a limitation. Future

investigations could benefit from employing a broader range of methodologies, such as quantitative or mixed methods approaches, to provide more comprehensive evidence. The use of a single case study in this work also restricted opportunities for comparative analysis. Expanding the scope to include multiple institutions at national or international levels could yield richer and more generalisable insights. In addition, further research is recommended to assess the long-term influence of capstone projects on graduates' professional trajectories and to evaluate the impact of different educational strategies.

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