Collaborative Pathways in Clean Energy Research: A Cohort Supervision Model for Research Higher Degree Students

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ABSTRACT

CONTEXT

This paper delves into the evolving landscape of research higher degree (RHD) supervision, specifically within the realm of clean energy research at Central Queensland University. The established individual supervision model and emerging cohort-based approach are acknowledged, each bearing unique attributes in fostering student learning and academic growth. The study seeks to bridge the existing gap in knowledge concerning the efficacy of the cohort model in reducing time to thesis completion (TTC), increasing the probability of thesis completion (PTC), and cultivating reflective lifelong learning among RHD students.

GOAL

The main drive behind this work is to create an effective cohort supervision model meeting RHD supervision's core requirement, including fostering respectful engagement, nurturing quality relationships between supervisors and students, and facilitating critical thinking and knowledge sharing. This paper outlines the methodology used to build and assess this model, providing insights into its capacity to bolster student learning, support, and scholarly development in clean energy research. The research questions encompass the nature of RHD cohort supervision needs, qualitative assessment of the proposed model, and the ideal structure to minimise attrition and ensure timely progress.

METHODOLOGY

A qualitative, interpretive, contextual, and descriptive analysis approach was adopted to address research questions. This methodology enabled exploration of the feasibility and effectiveness of the cohort supervision model. The model comprises 4 academics, 9 RHD students, and a coordinator, structured into six distinct phases of learning. Data collection involved workshops, hands-on assistance, fortnightly progress meetings, peer support, and data collection through surveys and evaluations. The collected data were analysed, and outcomes were categorised into themes of supportive practice, reflective practice, and community of practice.

ACTUAL OUTCOMES

This study yielded a comprehensive cohort supervision model for RHD students in clean energy research. It promotes respectful engagement, quality relationships, critical thinking, and knowledge sharing. Preliminary feedback from students demonstrates positive experiences, suggesting the model's potential to enhance student learning and support while reducing attrition rates.

CONCLUSIONS

In conclusion, this study endeavours to contribute to advancing RHD supervision practices by developing and evaluating an innovative cohort supervision model.

KEYWORDS

Cohort supervision model, RHD student support, clean energy research.

Introduction

Effective research higher degree (RHD) student supervision is pivotal for cultivating advanced research skills and knowledge (Agné & Mörkenstam, 2018). Traditionally, one-on-one interactions between a student and a designated supervisor have been the norm, yielding valuable results (Robertson, 2017). However, the collective supervision model, or cohort model, has gained traction recently, where a group of students pursue independent yet related research projects concurrently (Hutchings, 2017). The effectiveness of such models is evaluated based on two critical indicators: time to thesis completion (TTC) and probability of thesis completion (PTC) (Agné & Mörkenstam, 2018).

Scholarship and reflective practices are vital in sustaining RHD candidates toward achieving their TTCs and PTCs (De Lange, Pillay, & Chikoko, 2011). Two supervision models exist in the literature: the traditional (individual) model, where a senior academic supported by associate supervisors guides a single student, and the cohort (collective) model, where a group of students in similar research areas work with a team of supervisors (Harrison, 2009). The best practices in supervision, especially concerning knowledge transfer, peer learning, and value creation of research, remain undetermined (De Lange et al., 2011). Reflective learning through peer support and feedback is crucial for lifelong learning in cohorts. Observing presentations, reflecting on one's work, and applying feedback for future activities are vital aspects of this process (De Lange et al., 2011; Rinne & Sivenius, 2007).

The existing literature underscores the need for a rigorous RHD cohort supervision model suitable for a changing environment. Such a model should create an environment conducive to the lifelong learning of students, where supervisory and peer support systems follow best practices (McKellar & Graham, 2017; McLeod et al., 2021). Despite the potential advantages, the exact conditions under which the cohort model influences TTC and PTC are still unclear.

This research seeks to bridge this gap by addressing three key questions: 1) What are the essential characteristics of supervision and support that serve the RHD cohort's needs at Central Queensland University (CQUniversity)? 2) How can the proposed cohort model be qualitatively assessed to determine its effectiveness in enhancing student support, communication, and reflective practices, ultimately advancing student learning outcomes? 3) What constitutes the optimal student cohort supervision and support structure, effectively mitigating attrition rates and ensuring timely progression?

By amalgamating insights from the literature, it is evident that a rigorous and reflective cohort supervision model holds significant promise in fostering a collaborative, supportive, and professional environment conducive to the lifelong learning and academic growth of RHD scholars. This research aims to develop an effective cohort model of RHD supervision and support system for enhancing student learning. To achieve this overarching aim, a comprehensive set of activities is undertaken, including the identification of the requisite nature of support for cohort supervision, a comparative analysis of the merits of the cohort model vis-à-vis conventional methods, the development of a robust methodology for evaluating the model's impact on TTC and PTC, and the identification of key skills essential for reflective learning on research projects. In conclusion, this paper underscores the importance of evolving RHD supervision models in the context of clean energy research, wherein the traditional individual approach is juxtaposed against the emerging cohort-based framework. Through a comprehensive examination of the nature of supervision, the potential of the cohort model, and the strategies for its implementation, this paper endeavours to contribute to the advancement of research and scholarship in the domain of clean energy research and RHD supervision.

Research Methodology

This study employs a research methodology that amalgamates elements from two distinct approaches. The first approach forms the foundation for our research design. It is rooted in qualitative, interpretive, contextual, and descriptive analysis, drawing inspiration from successful

qualitative models in the field (Vasset et al, 2021). This model guides developing and implementing a cohort supervision system tailored to RHD students in clean energy research at CQUniversity.

The second approach adopts a well-known design science method with a pragmatic philosophy. This method utilises a single-case study framework with students as the units of analysis. Data collection primarily involves supervisors, who collectively form part of the data sources. The study utilises focus groups and reflective questionnaires as data collection methods. The intervention design aligns with the pyramid cohort supervision model, emphasizing constructivist learning principles and cooperative learning dynamics.

The research design combines these two approaches to construct a comprehensive methodology for developing and evaluating the cohort supervision model. While the first approach primarily focuses on the conceptualisation and initial structuring of the model, the second approach extends the model's application to the proposal development phase for RHD students engaged in clean energy research. This expansion aims to foster collaborative peer interactions, encouraging students to critique each other's work and learn the art of self-critique.

Data collection encompassed multiple strategies, including seminars/workshops, hands-on assistance, fortnightly progress meetings, and peer support. We conducted two weekly workshops to discuss about cohort supervision model used elsewhere including science and engineering. In this cohort discussion, we had 4 academics (one professor, two senior lecturers and one lecturer) and 9 RHD students, which we believe is a decent size of cohort. In the hands-on assistance we had one-to-one session to go through the issues they are facing in their study/research or their preference of supervision style i.e. traditional or cohort supervision model. Our usual supervision style was traditional one-to-one supervision, where we discussed their progress fortnightly. They present their work they did in past two weeks and gave a plan/schedule of activities they will be performed in next two weeks which they present in their next fortnightly meeting. Our students were given the opportunity to discuss their supervision with students from other supervisors or other research groups. They share our conduct of supervision to get peers opinion and support where appropriate. It also involved student evaluations through open-ended questionnaires, supplemented by qualitative and quantitative online surveys conducted via the SLIDO platform. The collected data were analysed, and outcomes were categorised into themes of supportive practice, reflective practice, and community of practice.

The Cohort for this study consisted of nine RHD students in clean energy research at, four supervisors with varying levels of supervision experience and a coordinator. The CQUniversity central idea behind the Cohort was to facilitate peer learning by bringing together students working in similar research domains. An online project site was established to serve as a resource, communication, and interaction hub. Initial training workshops were conducted to familiarise students with the cohort approach and research module expectations.

The cohort model introduced several interventions, detailed in Table 1. These interventions aimed to foster collaboration, peer critique, and shared learning experiences. Face-to-face meetings were introduced for student presentations and feedback sessions. These sessions allowed students to condense their research ideas into presentation format, present their work orally, and engage in constructive critiques of their peers' work.

Students were assigned two supervisors, with the senior supervisor actively involved in overseeing all participating students' work. Feedback loops were established through drafts submitted to supervisors, creating a dynamic continuous improvement and refinement process.

Table 1: Cohort model interventions and activities

Stage	Event	Actions
1. Introduction and orientation	Tutorial letter and initial meeting	• Distributing a tutorial letter with module information • Sharing online resources through a dedicated wiki

		• Hosting an introductory group meeting with students, supervisors, and staff • Collecting initial feedback on research questions
	Guest speakers and reflective sessions	• Organising a series of three seminar/workshop sessions • Inviting guest speakers to address various aspects of cohort supervision • Facilitating reflective sessions and smaller group discussions
2. Research design	Individual meetings and presentations	• Conducting individual meetings with supervisors • Facilitating informal group interactions • Organising presentations to the group and external supervisors on literature review and research questions
3. Proposal development	Proposal presentations and focus group	• Hosting a meeting for proposal presentations • Conducting a focus group to evaluate research approaches
4. Fortnightly progress meetings and peer support	Regular meetings for progress evaluation	• Conducting regular fortnightly meetings with the supervisory team and students • Providing a platform for progress evaluation and presentations • Offering feedback and establishing a peer support network
5. Data collection and ethical clearance	Student evaluations	• Collecting student evaluations through open-ended questionnaires • Conducting qualitative and quantitative online surveys using the Slido platform
6. Data analysis and reporting	Analysing data and categorising outcomes	• Analysing collected data • Categorising outcomes into supportive practice, reflective practice, and community of practice themes • Utilising findings to enhance engagement, learning, and a sense of belonging within the cohort community

Results and Discussion

Assessment derived from the students' feedback

The students' experiences with the cohort supervision model, based on their responses to the questionnaire provided in Appendix A shed light on the potential benefits, challenges, and recommendations associated with this approach.

Benefits of cohort supervision:

Overall, the students perceived several benefits in the cohort supervision model. They highlighted that it could provide valuable support in addressing challenges they faced during their RHD journey. The potential benefits they noted include:
- **Enhanced support structure:** Students expressed a desire for a more robust support structure, and the cohort model appeared promising in this regard. They believed that it could offer a supportive network that would help them navigate the challenges of their RHD studies.
- **Peer support:** Many students recognised the value of peer support within the cohort model. They believed that collaborating with peers who share similar academic pursuits

could facilitate the exchange of knowledge and experiences, potentially accelerating their research progress.
- **Reflective practices:** Reflective practices were viewed as crucial for personal and academic growth. Students anticipated that the cohort model could offer tools and resources to aid in reflective practices, fostering deeper introspection and learning.
- **Reduced time to thesis completion:** Some students believed that the cohort model had the potential to expedite their time to thesis completion. They anticipated that the collaborative environment and peer support could contribute to more efficient progress.
- **Optimised communication:** Students recognised the importance of effective communication within the cohort model. They identified the need for strategies to optimise communication and ensure that valuable insights and feedback were shared among cohort members.

Challenges and considerations:

While the students were generally optimistic about the cohort supervision model, they also raised some considerations and challenges:
- **Transition challenges:** Students acknowledged that transitioning from a traditional supervision model to a cohort model might present challenges. They anticipated potential resistance to change and the need for careful planning to facilitate a smooth transition.
- **Individual needs:** Some students emphasised the importance of maintaining one-on-one interactions with their supervisors. They believed that while the cohort model was valuable, it should complement rather than replace individualised supervision.

Recommendations for Improvement:

To optimise the cohort supervision model, students made several recommendations:
- **Structured support:** Students emphasised the need for a structured support system within the cohort model. They suggested that regular meetings and opportunities for knowledge exchange should be integral to the approach.
- **Peer support enhancement:** Students highlighted the importance of fostering peer support within the Cohort. They recommended creating platforms for collaborative learning and sharing resources.
- **Tools and resources:** Students expressed a desire for tools and resources that would aid in reflective practices. They suggested the incorporation of resources that facilitate self-assessment and personal growth.
- **Communication strategies:** Effective communication strategies were deemed essential. Students recommended clear guidelines for communication and mechanisms for sharing feedback and insights.

Assessment derived from the supervisors' feedback

The insights gleaned from supervisors' responses in Appendix B shed light on the advantages and challenges of implementing a cohort-based supervision model, especially tailored for the Engineering and Technology sector.

Supervisors identified a range of common challenges faced by Research Higher Degree (RHD) students. These challenges encompassed maintaining research focus, effective time management, aligning research objectives with available resources, and grappling with isolation, particularly in highly specialised research areas.

Supervisors expressed keen interest in evaluating the cohort model, foreseeing its potential to offer benefits such as increased peer support, collaborative learning opportunities, and a stronger sense of community among students. However, they underscored the importance of striking a balance between providing individualised attention and fostering collaborative experiences.

Within the Engineering and Technology context, supervisors recognised both opportunities and potential challenges. While the sector offered prospects for cross-disciplinary collaboration, they

acknowledged the diverse nature of research topics as a potential hurdle in forming a cohesive cohort.

To navigate this, supervisors recommended a range of strategies. These included the creation of smaller, specialised sub-cohorts to cater to the diversity of research areas, regular one-on-one sessions with students, and structured activities aimed at promoting peer critique and collaboration.

Opinions on the anticipated workload implications varied among supervisors. Some envisioned a more equitable distribution of tasks among the team, while others noted the initial effort required for transitioning to the cohort model.

Supervisors emphasised the importance of fostering strong academic and student relationships within the cohort model. They proposed activities that encouraged regular interaction, mentorship, and support mechanisms. These activities encompassed seminars, workshops, and peer reviews to enhance knowledge sharing, critical thinking, and problem-solving.

Moreover, supervisors recognised the value of technology and online platforms in enhancing accessibility and flexibility. They highlighted the significance of clear communication channels and transparent expectations to facilitate information exchange.

Regarding the ideal cohort structure, supervisors acknowledged the need for flexibility to accommodate the diverse array of research areas within the Engineering and Technology sector. They proposed a modular approach that allowed students to transition between sub-cohorts as needed, coupled with a well-defined framework for progress monitoring.

Supervisors also recognised that transitioning from a traditional to a cohort-based supervision model might encounter resistance and necessitate comprehensive training and phased implementation. Encouraging self-assessment, peer review, and structured reflection activities within the cohort model were seen as valuable for student development.

In summary, supervisors believed that the cohort model had the potential to enhance research quality in the Engineering and Technology sector. They emphasized the need for careful planning, ongoing support, and adaptability to harness this potential effectively. By addressing these challenges and embracing the recommended strategies, CQUniversity can capitalise on the cohort-based supervision model to enrich the research journey of RHD students in Engineering and Technology.

Proposed cohort model

Building upon our extensive experience and taking into account the unique requirements of RHD supervision, we propose a comprehensive cohort model designed to foster an enriching learning environment and facilitate robust scholarly development. This model, depicted in Figure 1, is meticulously structured to ensure that students receive the utmost support, supervision, and expert guidance.

Key actors in the cohort model:
- **Cohort leader**: At the helm of the cohort model stands the cohort leader, a seasoned supervisor who can provide vision and guidance when necessary. This individual may or may not serve as the immediate supervisor for the students. Their role is pivotal in steering the Cohort towards its goals and ensuring a cohesive learning journey.
- **Supervisors**: Supporting the cohort leader are the supervisors, including a mix of academics. These supervisors bring their extensive expertise and knowledge to the Cohort, providing invaluable mentorship and guidance to the students. They play a fundamental role in overseeing the students' research projects and scholarly development.
- **Coordinator**: To maintain the seamless flow of documents and coordinate cohort meetings effectively, a coordinator is an integral part of the model. This role ensures that

administrative tasks do not impede the progress of the students and supervisors, enabling a more efficient learning process.

- **Students**: The heart of the cohort model is the RHD students, who are the primary beneficiaries of this structured approach. These students engage in research within the realm of clean energy and form the core focus of the cohort model.

Figure 1 illustrates the structural framework of our proposed cohort model, visualising the relationships and interactions among the key actors within the Cohort. This model is purpose-built to support student learning, foster the development of research professionals, and promote scholarship in learning and teaching.
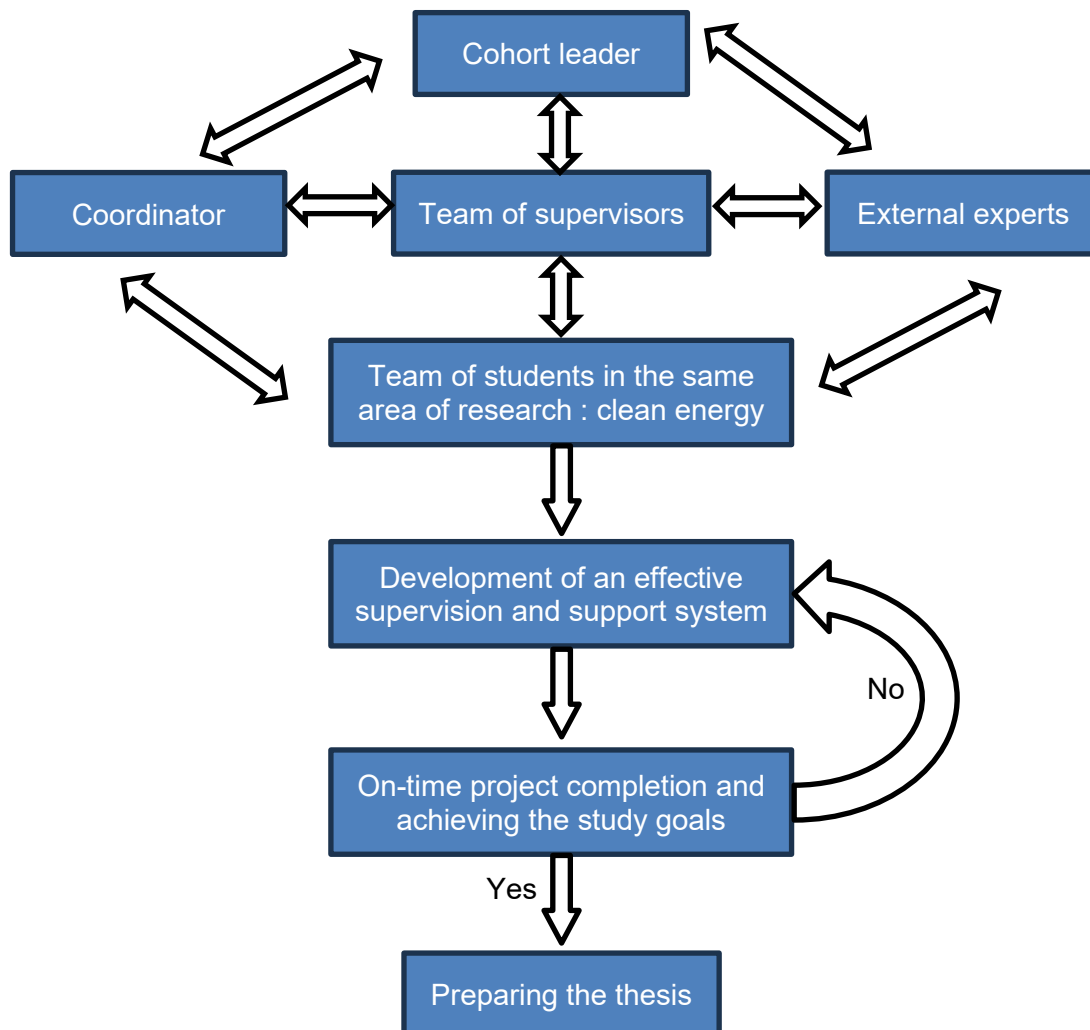

Figure 1: Proposed cohort supervision model

Conclusion and Future Work

This study has provided valuable insights into the development of a tailored cohort-based supervision model for the Engineering and Technology sector, addressing the unique challenges faced by RHD students. Supervisor feedback highlighted critical issues, including focus, time management, and isolation, affirming the cohort model's potential to mitigate these challenges through peer support and collaborative learning. Additionally, students' feedback towards developing the cohort model has been overwhelmingly positive, with many noting benefits such as improved project quality, enhanced communication skills, and a sense of belonging within the cohort community. The proposed model, which emphasises structured sub-cohorts, one-on-one sessions, and reflective practices, offers a promising approach to balancing individualised

attention with collaborative learning experiences. While the workload implications may vary, they can lead to fair task distribution and better student performance in the long run. Effective communication, transparency, and a modular supervision structure remain central to successful implementation, acknowledging potential resistance during the transition. Future work will involve the practical implementation of the cohort model, including seminars, workshops, and data analysis, with continuous evaluation and adaptation to ensure responsiveness to evolving student needs. In summary, the cohort-based supervision model holds great promise for enhancing RHD students' research journeys, fostering a supportive and enriching learning environment, and contributing to learning and teaching scholarship in Engineering and Technology.

Appendix A: Questionnaire for RHD Students

- How would you describe your current supervision experience at CQUniversity?
- What challenges have you faced in your RHD journey that you believe could be addressed with a different supervision model, for instance, Cohort based supervision model?
- What kind of support structure would you find most beneficial for your RHD study?
- How do you view the concept of cohort-based supervision in comparison to your current experience?
- Do you believe peer support in a cohort-based model would be beneficial for your research journey?
- What tools or resources would be helpful in a cohort supervision model to assist in reflective practices?
- Do you believe a cohort supervision model would speed up your time to thesis completion? How can communication be optimised within a cohort supervision model?
- What structure do you believe would work best for student cohort supervision to ensure minimal attrition and maximum student support?
- How do you foresee the transition from a traditional supervision model to a cohort model, and what challenges might arise during this transition?
- How can the cohort model be designed to facilitate deeper I self-reflection and enhance learning outcomes for students?
- Do you believe the cohort model would enhance the overall value of the conducted research at CQUniversity?

Appendix B: Questionnaire for Supervisors

- What are the primary challenges faced by RHD students in their journey?
- How do you perceive the effectiveness of the current supervision model versus a cohort-based model?
- What potential advantages or disadvantages do you see with a cohort-based supervision model for the Engineering and Technology sector?
- How can we ensure that a cohort supervision model provides both the required individual attention to students as well as collaborative learning experiences?
- Do you think using a cohort supervision model would lessen or augment your supervisory duties? How can such a model promote close bonds among members of the team? do you believe a cohort supervision model would reduce or increase your supervisory responsibilities?
- How can a cohort model foster strong academic and student relationships to ensure on-time project completions?
- What are some effective methods or activities to enhance the proposed cohort supervision model? What are some ways to improve communication in a cohort supervision model? What structure do you believe would work best for student cohort supervision to ensure minimal attrition and maximum student support?
- How do you envision the transition from a traditional supervision model to a cohort model, and what challenges might arise during this transition?

- How can the cohort model be structured to promote deeper self-reflection and enhance learning outcomes for students?
- Do you believe the cohort model would enhance the overall value of the conducted research at CQUniversity?

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