Peer Beyond Graduate Research Conference | Volume 2, Issue 1| Pages 25–26

What Drives Careers in Quantum Research? Insights from Researchers' Trajectories

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Abstract: Canada faces a shortage of quantum researchers, underscoring the need to understand what drives career choices in this field. With a sociocultural perspective, this study employed a sequential multi-method qualitative design, including content analysis of 23 documents and nine interviews with quantum researchers. Findings reveal that educators and mentors shape trajectories through support, career opportunities, and affect-informed guidance. These insights inform educational practices to foster sustained interest and expertise in quantum research.

Introduction and purpose of the study

A nation's capacity to advance quantum technologies is closely linked to its broader potential for scientific development and innovation. Recognizing this connection, several countries have begun to treat the cultivation of a highly specialized quantum workforce as a strategic priority. Canada, for instance, is among the countries that have invested significantly in this field (Sussman et al., 2019) and recently implemented the 2023 National Quantum Strategy (Innovation, Science and Economic Development Canada, 2023). Despite these efforts, the country faces a persistent shortage of researchers needed to sustain its leading position in quantum innovation. In this context, understanding what motivates individuals to pursue careers in this highly specialized area has become urgent. This study adopts a sociocultural perspective (Vygotsky, 1978) to explore factors that influence quantum researchers' (QRs) career choice, with emphasis on the role of educators and mentors.

Methodology

We employed a sequential, multi-method qualitative design (Creswell & Poth, 2018) to address two research questions: (1) *What factors influenced quantum researchers to pursue this career?* and (2) *How did educators and mentors contribute to participants' decisions to pursue quantum research?*
In Phase 1, we conducted an inductive content analysis (Elo & Kyngäs, 2008) of acknowledgment sections from 23 publicly available quantum-related theses and dissertations. Findings from this phase informed Phase 2, which involved semi-structured interviews with nine quantum researchers across diverse career stages. Interview transcripts were analyzed to identify emerging themes (Proudfoot, 2023). Data from both phases were subsequently integrated and triangulated (Creswell & Plano Clarke, 2018).

Findings

Findings indicate that educators and mentors played a central role in shaping participants' academic trajectories, particularly by influencing their relationship with and sustained interest in quantum research. Analysis of data from both phases of the study revealed three key ways in which educators and mentors contributed to quantum researchers' decisions to pursue and remain in this field:

1. *Supporting learning*: offering timely feedback and helping students develop essential knowledge and skills to succeed as a QRs, such as critical thinking, experimentation, and technical knowledge.

2. *Providing career opportunities*: encouraging conference participation, publication, and external research, while leveraging their networks to facilitate job placement.

3. *Adopting an affect-informed approach*: demonstrating kindness, patience, belief in student potential, encouraging perseverance, modeling research enthusiasm, and fostering agency through collaborative engagement.

These findings are consistent with Vygotsky's (1978) sociocultural theory, emphasizing the importance of the mediation provided by educators and mentors in learning and in enabling reflection on how this mediation influences motivation, engagement, and long-term commitment to quantum research.

Conclusion and Implications

Uncovering the factors that shape quantum research career trajectories is critical at this moment in time and carries both economic and educational significance. Overall, the results of this study highlight how educators and mentors influence career decision-making and offer evidence-based insights into how educational practices can support the development of sustained interest and expertise in quantum research, a field critical to Canadian scientific and technological advancement as well as the development of a future quantum workforce.

References

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.) Sage.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches (4th ed.). Sage.*

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing, 62*(1), 107–115. https://doi.org/10.1111/j.1365-2648.2008.04569.x

Innovation, Science and Economic Development Canada. (2023). *National Quantum Strategy*. https://ised-isde.canada.ca/site/national-quantum-strategy/en

Proudfoot, K. (2023). Inductive/deductive hybrid thematic analysis in mixed methods research. *Journal of Mixed Methods Research, 17*(3), 308-326. https://doi.org/10.1177/15586898221126816

Sussman, B., Corkum, P., Blais, A., Cory, D., & Damascelli, A. (2019). Quantum Canada. *Quantum Science and Technology, 4*(2), 020503. https://doi.org/10.1088/2058-9565/ab029d

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.