



OPEN ACCESS

EDITED BY

Susana Henriques,
Universidade Aberta (UAb), Portugal

REVIEWED BY

Ana Patrícia Almeida,
Universidade Aberta, Portugal
Juciano de Sousa Lacerda,
Federal University of Rio Grande do
Norte, Brazil
Maria Goulão,
Universidade Aberta, Portugal

*CORRESPONDENCE

Ali Chaari
✉ alc2033@qatar-med.cornell.edu

RECEIVED 09 July 2024

ACCEPTED 30 October 2024

PUBLISHED 15 November 2024

CITATION

Mahboob A and Chaari A (2024) Student
leadership in medical school research.
Front. Educ. 9:1462256.
doi: 10.3389/feduc.2024.1462256

COPYRIGHT

© 2024 Mahboob and Chaari. This is an
open-access article distributed under the
terms of the [Creative Commons Attribution
License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or
reproduction in other forums is permitted,
provided the original author(s) and the
copyright owner(s) are credited and that the
original publication in this journal is cited, in
accordance with accepted academic practice.
No use, distribution or reproduction is
permitted which does not comply with these
terms.

Student leadership in medical school research

Annas Mahboob and Ali Chaari*

Weill Cornell Medicine Qatar, Qatar Foundation, Education City, Doha, Qatar

KEYWORDS

student-centered learning, students research and training program, research education, curriculum, learning

Introduction

Research is an integral component of medical education, serving as a conduit for advancing medical knowledge and practice. It provides students with opportunities to enhance their understanding of scientific concepts, develop critical thinking skills, and contribute to significant medical discoveries. However, a major limitation of such research is that it requires extensive training and mentorship for young students. Often, there are not enough primary investigators (PIs) for all students, resulting in many students being bereft of opportunities to engage in such research (Amador-Campos et al., 2023; Talbert et al., 2021; Zhang and Swaid, 2017). The growing demand for research opportunities among students, combined with a limited pool of experienced faculty mentors, has led to bottlenecks at many universities. As more students seek personalized guidance, the available research faculty are increasingly stretched, often compromising the quality of mentorship (Hewerston, 2015; Nolan et al., 2020). This issue is especially pronounced in fields like medical and biomedical sciences, where research engagement is emphasized early in academic training, further intensifying the need for capable mentors (Kent et al., 2022).

To address this problem requires a rethinking of how to engage more students in research during medical school in a sustainable manner. For example, Weill Cornell Medicine-Qatar (WCM-Q) has implemented project-based learning, where faculty present a single research problem, and students work in small teams to conduct lab research and write reports on their findings. This method allows many students to participate in research under the guidance of a single faculty member (Chaari et al., 2020). Another possible approach, already widely implemented for educational progress, is the implementation of mentorship programs, where senior students guide and mentor junior students, leveraging their experience and skills (Bolton-King, 2022; Gehreke et al., 2024).

In this opinion piece we propose the widespread adoption of the *senior student researcher mentoring* model across medical schools globally, as used in WCM-Q, consisting of the involvement of senior students in leading research projects, guiding junior students through the complexities of scientific inquiry. This model not only enhances the research experience but also cultivates leadership and mentorship skills that are crucial for professional development, and promises to be a useful resource for building institutional knowledge.

Senior students leading junior students

Several case studies highlight the benefits of collaborative research projects involving senior and junior students. At the Hong Kong Polytechnic University (PolyU), the Junior Researcher Mentoring Programme has successfully paired high school students with university scholars to conduct thematic research across various disciplines. The program

has not only ignited an interest in research among younger students but has also led to significant academic achievements, such as presentations at international conferences and recognition through awards for innovative projects (Harrison et al., 2019). The success of this initiative is detailed in the report “Junior Researcher Mentoring Programme 2022 Returns to Offer More Exciting Research Projects for Secondary School Students”, published in February 2022, issue 15. Similarly, the 3M mentoring model at Botho University has shown promising results. In this model, senior students mentor their juniors, guiding them through academic challenges and helping them to grasp course content better and develop effective study strategies. This model has proved particularly beneficial in connecting theoretical knowledge with practical application, thus preparing students for the challenges of the professional world (Torres et al., 2011).

In our proposed model (Figure 1), senior students taking on leadership roles in research projects exemplify a model of mentorship that benefits both the mentor and the mentee. The first step in this process involves carefully selecting senior students who demonstrate exceptional academic performance, professionalism, dedication, and a proven track record in research. Once these students are chosen, they will receive comprehensive training and mentorship from the principal investigator (PI) to prepare them for their upcoming roles. This training will enhance their skills and confidence as they transition into co-mentoring positions with junior students, fostering a supportive and collaborative research environment.

The responsibilities of senior student leaders include overseeing research activities, ensuring the quality and accuracy of the research, providing guidance on drafting research papers, and acting as a conduit of dynamic and streamlined communication between the faculty PI and the junior students. This arrangement creates a collaborative environment where junior students learn from senior peers, enhancing scientific writing, data analysis, and critical thinking skills. Beyond just supervising, senior students act as role models, demonstrating effective research practices and professional behaviors. This direct mentorship enables junior students navigate the complexities of research projects, from developing hypothesis to interpreting data and writing manuscripts.

Additionally, as senior students articulate concepts and methods to their mentees, they gain a more profound comprehension themselves of their research topics.

Examples of senior student researcher mentoring model in medical schools are scarce in existing literature, yet our pilot program serves as the inspiration behind this article. At Weill Cornell Medicine Qatar, a biochemistry professor's adoption of the *senior student researcher mentoring* model marked a notable improvement in both the quantity and quality of research publications. Before implementing this model, the professor's team produced a modest number of publications, with 3 papers in 2019, 9 in 2020, 9 in 2021, and 8 in 2022. However, after integrating the model, there was a significant uptick in output. The team published 16 high-quality, peer-reviewed papers in 2023, many of which received substantial contributions from senior students whom the professor had mentored in earlier years. Additionally, in 2023, a noteworthy development occurred: one of the junior

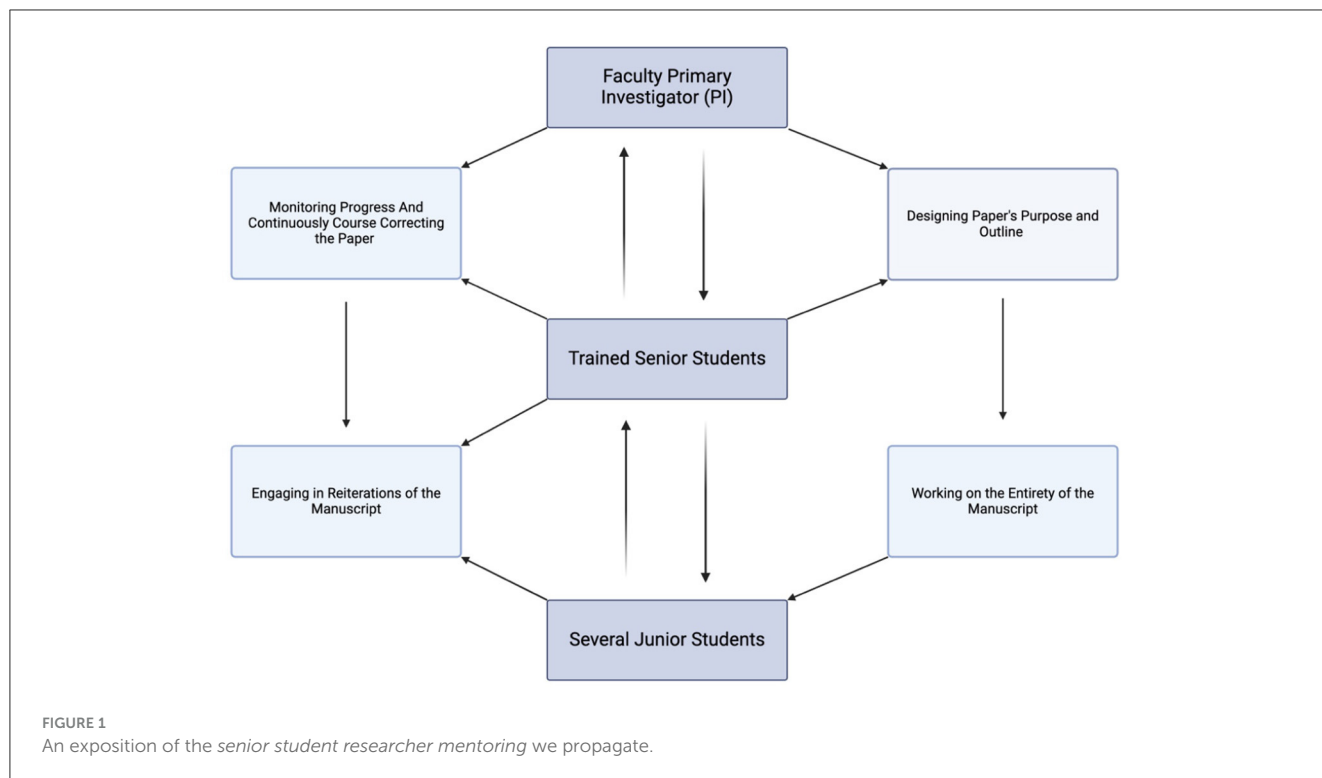
students who had previously benefited from the senior researchers' guidance has now transitioned into a mentoring role, guiding younger student researchers. In 2024, the program continues and anticipates further yield, with four students taking on roles as senior student researchers this year, further broadening and diversifying the research potential of the program. This rapid progress shown by our pilot program in medical school student research is a testimony to the developmental ability of the *senior student researcher mentoring* program.

The relationship between faculty PI, student mentor, and student mentee

This swift advancement within our pilot program for medical school student research underscores the effectiveness of the senior student researcher mentoring initiative in fostering developmental growth. Our proposed model (Figure 1) features a well-structured relationship among the faculty PI, senior student mentors, and junior student mentees. The faculty PI selects senior student mentors based on their professionalism, academic performance, research standing, and demonstrated time management skills. Once selected, student mentors regularly meet with junior mentees either weekly or bi-weekly to provide guidance and feedback. Then, student mentors relay insights and queries between the juniors and the PI, effectively streamlining interactions. This setup streamlines communication, allowing the PI to manage an increasing number of research papers while ensuring that junior mentees receive consistent and thorough guidance. Additionally, the PI directly addresses any conflicts on scientific contents related to the research to ensure swift resolution. Implementing this strategy allows the faculty to increase their research output by leveraging the capabilities of senior students, who in turn acquire valuable mentoring experience. Such a program addresses the significant gap in medical research where many students seek research opportunities, but there are not enough PIs with the time to mentor them. By integrating senior students into the mentoring framework, institutions can maintain and potentially enhance their research activities, enriching the experience for all involved.

Benefits of implementing student leadership in research program

Based on our experience implementing the *senior student researcher mentoring* model, we have noted numerous benefits. For junior students, it offers several advantages. Most importantly, it increases their chances of securing research opportunities, especially considering that, under normal circumstances, there aren't enough primary investigators (PIs) available to mentor all students. Secondly, the implemented concept creates a structured and nurturing environment that promotes the development of essential research skills while fostering student confidence. Junior students receive hands-on mentoring from experienced senior students, who help them navigate the complexities of research projects and methodologies. Additionally, they gain



valuable insights and direction from the primary investigator (PI), ensuring both practical guidance and professional supervision. This dual-layered mentorship not only accelerates their learning curve but also encourages collaboration and independent thinking, better preparing them for future academic or research opportunities. For senior students, leading a research team offers a valuable opportunity to enhance their leadership, communication, and organizational skills. It allows them to manage project timelines, delegate tasks effectively, and mentor junior students—key competencies that are essential for future roles in both clinical practice and academia. Additionally, the experience helps them build confidence in decision-making, fosters collaboration, and strengthens their ability to translate research findings into actionable outcomes, all of which are critical for pursuing advanced research positions or leadership roles in healthcare and education. While junior students feel more connected to their academic environment and are more motivated to engage in research, senior students experience satisfaction from contributing to the growth and success of their peers. This reciprocal relationship strengthens the academic community and promotes a culture of continuous learning and improvement.

With medical residencies becoming increasingly competitive, research during medical school is now a highly sought-after avenue. Based on our observations, the *senior student researcher mentoring* model provides a unique solution by enabling increased medical research without expanding the number of faculty PIs. Additionally, it helps build institutional knowledge as established research practices become ingrained within the institution and are passed down through successive generations of students, preserving healthy practices.

Challenges and solutions

The *senior student researcher mentoring* model can present challenges, such as differences in skill levels between the mentor and mentee, communication barriers, and potential conflicts over authorship. These challenges can be exacerbated by the hierarchical nature of traditional academic settings, where junior students may feel intimidated or reluctant to voice their opinions to senior students and faculty principal investigator. To address these challenges, institutions can implement structured mentorship programs that include training for mentors, clear guidelines on roles and responsibilities, and regular feedback sessions (Cruz Rivera et al., 2017). Training programs aimed at senior students can equip them with essential mentorship skills beyond technical knowledge. These programs emphasize clear communication, helping mentors convey complex ideas effectively to junior peers. Conflict resolution techniques prepare students to address misunderstandings or differing expectations within teams. Additionally, time management skills enable senior students to balance their research duties with mentoring responsibilities, ensuring productive sessions without compromising their academic workload. These competencies collectively foster a collaborative environment, promoting professional development for both the mentors and mentees (Bright, 2019; Nimmons et al., 2019). Providing clear guidelines on authorship and contributions in research teams is crucial for preventing conflicts, ensuring that all team members feel valued and recognized for their efforts, and enhancing the quality of research output. Such guidelines help delineate roles and responsibilities, fostering accountability and minimizing misunderstandings that can lead to disputes over credit. Studies indicate that when team members understand

their contributions are acknowledged, it boosts morale and collaboration, ultimately resulting in more productive research environments (Roje et al., 2023). Furthermore, having a structured approach to authorship can improve the integrity of the research process and the reliability of findings (Steneck, 2006). Thus, clear authorship guidelines are essential for promoting a collaborative and effective research culture.

Fostering a culture of open communication and mutual respect is crucial for the success of these programs. Regular meetings and feedback sessions help identify and address issues early, ensuring a positive and productive mentoring relationship. Institutions can also provide resources and support for mentors and mentees, such as access to counseling services, professional development workshops, and networking opportunities (Doukas et al., 2022).

Finally, one of the primary goals of conducting research is to enable students to achieve peer-reviewed publications, thereby disseminating their research efforts effectively. However, one significant challenge faced in this process is securing funding for publication fees. At WCMQ, both the principal investigator (PI) and the students receive diverse support from various sources, including departmental funds, institutional library resources, and assistance from the Qatar National Library. Despite these resources, the increasing number of students engaged in research and their corresponding publication needs make it increasingly difficult to fund all these publications adequately (Šobota, 2020). As the demand for publication continues to grow, it is essential to explore additional funding opportunities or partnerships to ensure that all deserving research efforts can be shared with the broader scientific community (Ashcraft et al., 2020). To address the challenge of securing funding for publication fees for students engaged in research, a solution can arise perhaps from having collaborative funding models by encourage collaboration among different departments and research groups to pool resources for publication fees. This model could involve sharing costs for multiple publications, which would reduce the individual financial burden on students and departments. Other solution is to negotiate more agreements with publishers for reduced fees or with waiver fees and give some priority for the publications involving students or provide sponsorships for current students' research. By implementing these strategies, institutions can better support their students in overcoming the financial challenges associated with publishing their research, ultimately enhancing academic dissemination and contributing to the broader scientific community.

Conclusion

In conclusion, we propose the widespread adoption of our *senior student researcher mentoring* model across medical schools globally. This model aims to provide widespread opportunities for undergraduate students to gain research experience, enhance their research skills during their medical education, and promote

professional development and growth for mentors and mentees. As medical education continues to evolve, it is essential to explore and implement effective mentorship strategies that support the next generation of medical researchers and practitioners, ensuring that research is sustainable and productive. The mentorship model fosters a collaborative learning environment, preparing students for future clinical and academic roles. To maximize the benefits of this model, institutions should invest in training and support for junior student mentors, establish clear guidelines and expectations, and promote a culture of open communication and mutual respect. By doing so, they can create a more inclusive and supportive academic environment that encourages innovation, collaboration, and continuous learning.

Author contributions

AM: Data curation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. AC: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Acknowledgments

We thank Dr. Philippe Piccardi from the Weill Cornell Medicine—Qatar Health Sciences Library for his invaluable contributions to editing and improving the manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

- Amador-Campos, J. A., Peró-Cebollero, M., Feliu-Torruella, M., Pérez-González, A., Cañete-Massé, C., Jarne-Esparcia, A. J., et al. (2023). Mentoring and research self-efficacy of doctoral students: a psychometric approach. *Educ. Sci.* 13:358. doi: 10.3390/educsci13040358
- Ashcraft, L. E., Quinn, D. A., and Brownson, R. C. (2020). Strategies for effective dissemination of research to United States policymakers: a systematic review. *Implement. Sci.* 15:89. doi: 10.1186/s13012-020-01046-3
- Bolton-King, R. S. (2022). Student mentoring to enhance graduates' employability potential. *Sci. Just.* 62, 785–794. doi: 10.1016/j.scijus.2022.04.010
- Bright, A. L. (2019). Practicing leadership skills through peer mentoring and teaching: the lived experience of BSN students. *Int. J. Nurs. Educ. Scholarsh.* 16:22. doi: 10.1515/ijnes-2019-0022
- Chaari, A., Al-Ali, D., and Roach, J. (2020). Biochemistry course-based undergraduate research experience: purification, characterization, and identification of an unknown lactate dehydrogenase isoenzyme. *Biochem. Mol. Biol. Educ.* 48, 369–380. doi: 10.1002/bmb.21363
- Cruz Rivera, S., Kyte, D. G., Aiyegbusi, O. L., Keeley, T. J., and Calvert, M. J. (2017). Assessing the impact of healthcare research: a systematic review of methodological frameworks. *PLoS Med.* 14:e1002370. doi: 10.1371/journal.pmed.1002370
- Doukas, D. J., Ozar, D. T., Darragh, M., de Groot, J. M., Carter, B. S., and Stout, N. (2022). Virtue and care ethics and humanism in medical education: a scoping review. *BMC Med. Educ.* 22:131. doi: 10.1186/s12909-021-03051-6
- Gehreke, L., Schilling, H., and Kauffeld, S. (2024). Effectiveness of peer mentoring in the study entry phase: a systematic review. *Rev. Educ.* 12:e3462. doi: 10.1002/rev3.3462
- Harrison, M. G., Luk, B., and Lim, L. (2019). 'You know what, this is kind of helping me': students' experiences of a hong kong school-based mentoring programme. *Asia Pac. Educ. Res.* 28, 149–157. doi: 10.1007/s40299-018-0421-2
- Hewerston, H. (2015). "Undergraduate research internships: Engaging students in the co-creation of research," in *Creative Education, Teaching and Learning: Creativity, Engagement and the Student Experience*, eds. G. Brewer, and R. Hogarth (Palgrave Macmillan), 265–276. doi: 10.1057/9781137402141_25
- Kent, B. A., Holman, C., Amoako, E., Antonietti, A., Azam, J. M., Ballhausen, H., et al. (2022). Recommendations for empowering early career researchers to improve research culture and practice. *PLoS Biol.* 20:e3001680. doi: 10.1371/journal.pbio.3001680
- Nimmons, D., Giny, S., and Rosenthal, J. (2019). Medical student mentoring programs: current insights. *Adv. Med. Educ. Pract.* 10, 113–123. doi: 10.2147/AMEP.S154974
- Nolan, J. R., McConville, K. S., Addona, V., Tintle, N. L., and Pearl, D. K. (2020). Mentoring undergraduate research in statistics: reaping the benefits and overcoming the barriers. *J. Stat. Educ.* 28, 140–153. doi: 10.1080/10691898.2020.1756542
- Roje, R., Tomić, V., Buljan, I., and Marušić, A. (2023). Development and implementation of research integrity guidance documents: explorative interviews with research integrity experts. *Account. Res.* 30, 293–330. doi: 10.1080/08989621.2021.1989676
- Šobota, D. (2020). Critical open access literacy as a strategy to confront the challenges in scholarly communication. *J. Document.* 80, 168–186. doi: 10.1108/JD-08-2023-0155
- Steneck, N. H. (2006). *RCR QRP FFP Fig. 1. Current framework for Defining Research Behaviors*. Cham: Springer.
- Talbert, P. Y., Perry, G., Ricks-Santi, L., de Laurido, L. E. S., Shaheen, M., Seto, T., et al. (2021). Challenges and strategies of successful mentoring: the perspective of leads scholars and mentors from minority serving institutions. *Int. J. Environ. Res. Public Health* 18:6155. doi: 10.3390/ijerph18116155
- Torres, I. C., Chova, L. G., and Martinez, A. L. (2011). *Proceedings of the 4th International Conference on Education, Research and Innovation held on 14-16 November 2011 in Madrid, Spain*. International Association of Technology, Education and Development (IATED).
- Zhang, C., and Swaid, S. (2017). *Undergraduate Research Experience. Education Research, Contemporary Issues in Education Research*. Littleton, CO: Clute Institute.