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The clinician-scientist pipeline: undergraduate and postgraduate supply, leaks and perspectives

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Citation

Bakker, C. R. den. (2023, September 28). *The clinician-scientist pipeline: undergraduate and postgraduate supply, leaks and perspectives*. Retrieved from <https://hdl.handle.net/1887/3642424>

Version: Publisher's Version

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Note: To cite this publication please use the final published version (if applicable).

The background of the slide is an abstract composition of fiber optic lights. On the left side, numerous thin, dark fibers radiate outwards, some ending in bright, glowing orange and red circular bokeh spots. The right side of the slide is a solid, dark teal color. A thin vertical line separates the fiber optic area from the teal area.

Chapter 5

Twelve tips for fostering the next generation of medical teachers

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Medical Teacher, 2021

Abstract

Medical professionals with a special interest in and focus on education are essential to provide good quality education. Despite high numbers of students expressing an interest in teaching, concerns are rising regarding the supply of medical teachers, with few junior educators on the career ladder. To date, only some medical schools offer in-depth courses to students wanting to explore or aspire a career as a specialised medical teacher. We propose twelve tips for an elective course to foster the next generation of medical teachers. This course aims to enhance theoretical foundations and educational practices to cultivate the next generation of medical teachers.

Background

Teaching, patient care and research are the key responsibilities of medical doctors. In addition to teaching as part of good medical practice, doctors with a special interest in and focus on delivering education are needed: they have a pivotal role both as specialised medical teachers as well as educators of future medical professionals.¹ Despite high numbers of students interested in teaching, the shortage of medical teachers combined with few junior educators on the career ladder, is of growing concern.^{1,2} The lack of defined career pathways in teaching together with the emphasis on research at the expense of teaching are barriers in the medical teachers' workforce.^{1,2} Moreover, expanding student numbers and high expectations of educational quality and outcomes necessitate increasing numbers of scholarly medical teachers.¹

During medical school, the foundation for the different roles of a medical doctor is being laid. Most curricula have integrated electives to enable students explore medical fields of interest (e.g. research or public health) in-depth.³ However, similar courses on medical education are scarce.⁴ To cater to this need and to fulfil students' requests, we introduced an elective course on medical education for (bio)medical students. Two educational specialists defined essential key concepts for future medical teachers and created an elective to combine the theory and practice of teaching for 15 students yearly. During the years, the course was further developed, expanded, and a module regarding research into medical education was integrated. The latter was refined and coordinated by two medical education PhD candidates. In addition, the medical teaching community of our faculty is key in creating teaching opportunities within their courses, together with sharing their educational expertise as teaching specialists. This course resonates the three pillars of the faculty: clinic, education and research. Key concepts are educational theories, designing education, teaching, and medical education research. This course dives beyond the surface of teaching and includes didactics, pedagogy, psychology, philosophy, and research. Drawing on our experiences, literature, and theories, we propose twelve tips to build your own medical education elective for fostering the next generation of medical teachers.

Tip 1**Catch them young: Motivate students for teaching early in your program**

Not everyone is a born teacher. To become a competent medical teacher one needs to develop relevant teaching skills over time. Therefore, we recommend exposing students to teaching principles, theory, and techniques before taking on actual clinical teaching responsibilities. This means the provision of special (i.e. extracurricular or elective) courses in undergraduate programmes, followed by professionalisation through postgraduate education and into practice. Amorosa et al. describe that early teaching opportunities in medical students create awareness of the medical teacher role as part of their medical doctor identity, and thus moves this role from the hidden to the formal curriculum.⁵ Early identification with the teacher role might affect career orientation. Literature on enhancement of clinician–scientist career shows that early engagement of students in research triggers enthusiasm, helps to recognize talent, and stimulates future research engagement.^{6,7} Although no studies address early engagement in teaching as a means to enhance medical teacher careers, it seems fair to assume that catching potential medical teachers' young has similar effects on future engagement in education.

Tip 2**Put students in the driver's seat**

Learner agency and autonomy positively correlate with motivation for learning and student well-being.^{8,9} In addition, how teachers interpret and foster autonomy is closely connected to their own learning experiences.¹⁰ To promote autonomy and agency in future medical teachers, it is logical to put students in the driver's seat: make them responsible for their own learning as soon as possible. For example, based on Davidson et al., let students create a 'manifesto'.¹¹ This manifesto is a set of agreements participants consider to be important throughout the course, e.g. 'be on time or let the group know you are going to be late.' Another way to substantiate a student-centred approach is to grant students instructor rights in the Electronic Learning Environment (grading excepted). Make students responsible for their division into teams for groupwork and time frames for presentations. Additionally, let students design and execute part of the course assessment, and have them add a personal learning goal to the rubric used to assess the course research product.

Tip 3**Discuss epistemology and paradigms of teaching as starting point for students to explore their views on teaching**

For aspiring teachers, it is extremely valuable to be familiar with established views and paradigms of knowledge and learning, and how one's own vision relates to those.¹² This

can be a tool to explore the teacher they want to be, underpin educational designs, and place feedback on teaching from peers and students in a meaningful framework.^{13,14} Ask future medical teachers: 'What is knowledge?', 'How do we gain knowledge?', and 'What is the purpose of education?'. Next, offer insight into differences in assumptions between epistemologies, e.g. objectivism versus constructivism and paradigms of teaching, e.g. behaviourism, cognitivism, and constructivism, and eventually, challenge students to explore what paradigm(s) fits their own thoughts.^{12,15} This exploration can be facilitated by dividing a space into several zones that each represent a paradigm, asking students to literally take position where they feel most comfortable, and plenary discussing why. Students discover that peers may find themselves in other paradigms and how this increases mutual comprehension. In our experience medical students are mostly familiar with objectivist assumptions about knowledge and many feel enlightened, after some confusion, when their horizon broadens.

Tip 4**Be an implicit and explicit role model: Practice what you preach and let students in on your own reflection**

Role models are people we can identify with, who have qualities we would like to have, and are in positions we would like to reach.¹⁶ Students see teaching role models as being able to provide a constructive learning environment, a good understanding of the curriculum, and an ability to cater to the learning needs.¹⁷ Furthermore, role models influence students' decisions on their future career.¹⁸ Medical teachers can enhance their status as role models by developing a conscious awareness of role modelling.^{18,19} This requires teachers to explicitly articulate what aspects they are modelling. They have to practice what they preach, consciously show passion and enthusiasm towards teaching, and explain why they do the things they do. In addition, Benbassat et al. advocates that role models should share their doubts and uncertainties.²⁰ Especially, when teaching about teaching, instructors should reflect on their personal role as teacher, what it is like to be a teacher, which uncertainties they have, how they deal with complex situations, and how they combine a teaching career with clinical practice. Teachers should emphasize that any question about teaching is welcome. Eventually, this strengthens students' identification with and relatedness to teaching, and possibly a career as medical teacher.

Tip 5**Zoom out and show students the bigger educational picture**

Curricular design and complex organizational infrastructures underlying lectures, working groups and timetables are often unknown to students.²¹ Geraghty et al. showed that students with curricular organizational involvement appreciate the complexity of medical education and had more favourable views on it.²² They gain a new perspective:

Although teaching itself is often a one-person job, it is always designed, facilitated and integrated by a team and part of a wider programme in which many people are involved. As a teacher, it is important to realize you are part of this bigger picture and to have a good understanding of curriculum development, other stakeholders and influencing factors. With their knowledge, experiences and competencies, teachers are central to curricular development and the classroom delivery of the curriculum.²³ To make prospective medical teachers appreciate their role in the organization²² challenge students to critically evaluate their curriculum. Let students zoom out from their classroom and provide meet and greets with different stakeholders, e.g. curriculum coordinators, managers, etc, and discuss history and future of medical schools. In our experience, students learn to see education from different perspectives, and eventually, the bigger educational picture.

Tip 6

Introduce the basics of educational design, learning principles and theories

When constructing courses, alignment of desired learning outcomes, activities and assessment to optimize the effectiveness of learning is pivotal- the principle of constructive alignment.²⁴ Teachers must have the ability to design learning activities safeguarding this alignment. Therefore, equip students with basic knowledge about educational design, make them familiar with constructive alignment and with different teaching methods, e.g. flipped classroom principles or team based learning, and proper testing (i.e. formative and summative). In addition, introduce 'the first principles of instruction' for learning activities such as: *problem-centeredness, activation, demonstration, application, and integration*.²⁵ Since teachers' conceptions of learning and teaching affect their teaching behaviour²⁶ and probably their instructional designs, discuss and reflect on important learning theories, e.g. Leary's interaction rose to reflect on teaching experiences, Cognitive Load Theory to reflect on curricular overload, or Self Determination theory to reflect on student's wishes for electives.

Tip 7

Integrate designing for learning: Let students bring learning principles and theories into practice

In line with the previous tip together with the assumption that knowing and doing are inseparable students should design a learning activity based on theories and principles, e.g. sessions for each other with a self-chosen learning outcome.²⁷ Some may find it difficult where to start as most students are used to a rather tightly structured teacher and content centred curriculum. Provide structure by giving learning goals for this design assignment, examples, suggestions, expert feedback, and continuously express trust

in their capabilities. Another relevant hands-on designing element derived from Cathy Davidson includes contributing to the community by sharing what you have learned.¹¹ We playfully challenge the idea of sharing, and invite students to leave a legacy for their fellow teachers, in which they are completely free to choose what they want the teaching community to have. One group created a printed set of 'icebreaker' cards with concepts they had found in the literature to stimulate discussion about learning and teaching. Another group designed a mini booklet that teachers could put in their pocket, containing useful tips to stimulate interaction in classes, again based upon literature we used in class.

Tip 8

Provide (near-)peer education opportunities

Prospective medical teachers benefit from teaching (near-) peers as this enables them to actually apply their newly mastered knowledge, theories and teaching tools (*tips 3, 4, 6, 7*). Organizing near-peer education however can be challenging. Convince senior teachers of the added value to let students participate in teaching activities in the core curriculum. Students teaching (near-)peers brings new dynamics to small group teaching sessions. Less experienced, closer to their peers, they offer the learners other learning experiences than the sage on the stage, the expert clinician who knows everything but not necessarily is a good teacher.²⁸ As a guide on the side, (near-)peer teachers are approachable and have a greater understanding of the learner's perspective on the content at hand.²⁹ Learning outcomes when taught by (near)peers and faculty are similar.²⁹ Also, the student-teacher and senior teacher benefit from near-peer teaching constructions, as student teachers are assisted during their first teacher adventures, and senior teachers can step aside as they only need to provide a safety net to ensure students learn what they need to learn. Furthermore, senior teachers are challenged to reflect on the way they teach and contribute to their future workforce.

Tip 9

Provide students with knowledge about technology enhanced learning to prepare them for tomorrow's education

Technology Enhanced Learning (TEL) will definitely stay in the (medical) educational landscape. Enhanced by the COVID-19 pandemic online teaching has become much more standard, but it requires specific knowledge and skills. As such, students need to learn how to develop engaging online teaching activities and have opportunities to practice. Mishra and Koehler explained in their T-pack model that technical, pedagogical, and content knowledge need to be combined to offer proper education.³⁰ To know what expertise is required for TEL, introduce to students' concepts of blended learning, flipped, synchronous and asynchronous classrooms, and the T-pack model.

An advanced project combining *tips 6, 7 and 8* is to let students choose a TEL tool, for example virtual reality, serious games, or open educational resources. After exploring the possibilities and limitations, they teach a blended or online flipped class about the tool to each other. Finally, students should reflect on their knowledge and skills gain when designing and teaching. They can relate these knowledge and skills to the T-pack model to reach higher levels of learning according to Bloom's taxonomy.

Tip 10

Focus on reflection and involve peers in this process

Reflection is important as it helps teachers to collect, record, and analyse what happened during lessons.^{31,32} It allows teachers to move from just experiencing towards understanding, and it is an important source for personal and professional development.³¹ Be mindful that students might see their 'self' as teacher, but also still as student. We use microteaching techniques during class to prepare the students for real teaching, e.g. by recording their teaching and reflect on it together with an educational expert and peers.³³ This enables students' opportunities for discovering and reflecting on both their own and other's teaching styles and techniques. We suggest four reflection activities: invite students to reflect on their teacher role at least twice with a tried and trusted model.³⁴ Ask students to link their reflections to concepts and theories discussed in class to deepen their understanding of these concepts and theories by applying them to their own teaching behaviours and strategies. Encourage students to be creative in both reflection method and medium to stimulate the personal nature of reflection and avoid a 'ticking the box' approach.³⁵ We received reflective drawings, podcasts as well as written reports. Lastly, let students observe each other while teaching: both the teacher being observed and the observer to improve a teacher's professional practice and development will benefit.³⁶ This observation provides students with feedback from another perspective, creates opportunities to discuss challenges and successes with trusted colleagues, supports the sharing of ideas and expertise, and builds a community of trust.

Tip 11

Introduce the world of medical education research and let students participate

For medical education practice, teachers that understand and perform educational research are key.³⁷ In addition to being the foundation of evidence-based educational designs, research offers the tools to innovate and evaluate medical education practice. Most medical schools offer courses on (bio)medical research, but, as educational research lies in the social sciences domain, the toolkit of educational research questions, paradigms, and methodologies needs expansion to fit in and do justice to medical educational contexts.³⁸ To gain insight into the complexity and value of educational

research, let students create and present an authentic research product, e.g. a written research proposal, or a literature review. To support students in this project offer them journal clubs, workshops about paradigms, quantitative and qualitative methods, and literature search strategies. To guide students during their first steps in the world of medical education research, link them to a supervisor with medical education research experience.³⁹ Pay special attention to creating a relevant research question that students are interested in, and fitting an appropriate methodology, as students often struggle with this.

Tip 12

Build steppingstones for future educational steps

Once students have successfully completed their first in-depth course in medical education and have gained experience in teaching, they form a dedicated group of teaching assistants, and a talented pool for future medical teachers. As the lack of defined career pathways is one of the barriers in becoming a dedicated medical teacher, it is important to offer not only an elective in medical education but also consider it as a starting point for a medical teachers' career. Thus, offer students possibilities to move forward⁴⁰ and invite students to participate in a broad range of teaching activities and faculty activities such as faculty management, quality assurance, module and curriculum design or research in medical education, as a win-win situation for both students and faculty.⁴¹ During four years of running this course in the current format a new community with inspired junior teachers was born, eager and easily approachable to e.g. supervise (bio)medical working groups as side-job, or chair sessions during national medical education conferences. Others are involved in the development of an educational anatomy app funded by the faculty, or work together with educational experts to support course coordinators in blending their education. When feasible, they carry out their research proposal as a credit bearing research experience under supervision of a medical education researcher. Availability of grants and other incentives enabling participation in medical education (research) conferences will further engage students as members of the professional teachers' community. In addition, stimulate students to record teaching experiences and development in a teaching portfolio, and provide intervision opportunities for reflection and to foster coping strategies.⁴² The knowledge, skillset, and attitude students have acquired can be formally acknowledged by installing a Student Teaching Qualification, as a steppingstone towards a University Teaching Qualification and a career in medical education.

Conclusion

A targeted elective course in medical education enables students to get inspired before they need to take on their clinical role and consider future specialisation. Moreover, this course helps to recognize promising future colleagues and guide them further into the complex and exciting world of medical education. We are willing to share the education pack we have created, e.g. lesson plans and materials, with the medical teaching community for integration elsewhere.

We consider our undergraduate course on medical education a steppingstone in the career of a medical teacher. Moreover, these twelve tips can be valuable for all involved in developing medical teachers beyond the life of such undergraduate courses, including leaders of intercalated and postgraduate medical education degrees. We believe these tips can help both in designing smaller educational activities as well as extended courses to foster development of medical teachers.

References

1. Kandiah, D.A., Where is the next generation of medical educators? *The Medical journal of Australia*, 2013. 198(10): p. 534–535.
2. Bartle, E. and J. Thistlethwaite, Becoming a medical educator: motivation, socialisation and navigation. *BMC Med Educ*, 2014. 14: p. 110.
3. Sobral, D.T., Student–selected courses in a medical school: scope and relationships. *Med Teach*, 2008. 30(2): p. 199–205.
4. Dandavino, M., L. Snell, and J. Wiseman, Why medical students should learn how to teach. *Med Teach*, 2007. 29(6): p. 558–65.
5. Amorosa, J.M., Mellman, L.A., and Graham, M.J., Medical students as teachers: how preclinical teaching opportunities can create an early awareness of the role of physician as teacher. *Med Teach*, 2011. 33(2): p. 137–44.
6. Wolfson, R.K., et al., The Impact of a Scholarly Concentration programme on Student Interest in Career–Long Research: A Longitudinal Study. *Acad Med*, 2017. 92(8): p. 1196–1203.
7. Ommering, B.W.C., et al., Fostering the physician–scientist workforce: a prospective cohort study to investigate the effect of undergraduate medical students' motivation for research on actual research involvement. *BMJ Open*, 2019. 9(7): p. e028034.
8. Neufeld, A. and G. Malin, Exploring the relationship between medical student basic psychological need satisfaction, resilience, and well-being: a quantitative study. *BMC Med Educ*, 2019. 19(1): p. 405.
9. Ryan, R.M. and E.L. Deci, Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol*, 2000. 55.
10. Reinders, H. and C. Balçıkkanlı, Learning to Foster Autonomy: The Role of Teacher Education Materials. *Studies in Self-Access Learning Journal*, 2011. 2.
11. Davidson, C.N., *The New Education: How to Revolutionize the University to Prepare Students for a World In Flux*. 2017: Basic Books.
12. Baker, L., et al., Aligning and Applying the Paradigms and Practices of Education. *Academic Medicine*, 2019. 94(7): p. 1060.
13. McManus, D.A., The Two Paradigms of Education and the Peer Review of Teaching. *Journal of Geoscience Education*, 2001. 49(5): p. 423–434.
14. Hendriks, R.A., et al., Teaching modes and social–epistemological dimensions in medical Massive Open Online Courses: Lessons for integration in campus education. *Med Teach*, 2019. 41(8): p. 917–926.
15. Arbaugh, J.B. and R. Benbunan–Finch, An Investigation of Epistemological and Social Dimensions of Teaching in Online Learning Environments. *Academy of Management Learning & Education*, 2006. 5(4): p. 435–447.
16. Paice, E., S. Heard, and F. Moss, How important are role models in making good doctors? *BMJ*, 2002. 325(7366): p. 707–10.
17. Burgess, A., K. Goulston, and K. Oates, Role modelling of clinical tutors: a focus group study among medical students. *BMC Med Educ*, 2015. 15: p. 17.
18. Mohammadi, E., et al., Enhancement of role modelling in clinical educators: A randomized controlled trial. *Medical Teacher*, 2019. 42: p. 436 – 443.
19. Passi, V., et al., Doctor role modelling in medical education: BEME Guide No. 27. *Med Teach*, 2013. 35(9): p. e1422–36.
20. Benbassat, J., Role modeling in medical education: the importance of a reflective imitation. *Acad Med*, 2014. 89(4): p. 550–4.
21. Gold J, H.H., Hun D. , Understanding medical school leadership: medical teachers as agents of change. In: Dent J, Harden R, Hunt D, editors. *Practical Guide for Medical Teachers*. . 2017.
22. Geraghty, J.R., et al., Empowering medical students as agents of curricular change: a value-added approach to student engagement in medical education. *Perspectives on Medical Education*, 2019. 9: p. 60 – 65.
23. Alsubaie, M., Curriculum Development: Teacher Involvement in Curriculum Development. *Journal of Education and Practice*, 2022.
24. Biggs, J., Constructive alignment in university teaching. *HERDSA*, 2014. 1:5–22.
25. Merrill, M.D., First principles of instruction. *Educational Technology Research and Development*, 2002. 50(3): p. 43–59.
26. Jacobs, J.C.G., et al., An international study on teachers' conceptions of learning and teaching and corresponding teacher profiles. *Medical Teacher*, 2020. 42: p. 1000 – 1004.
27. Rencic, J., et al., Clinical reasoning performance assessment: using situated cognition theory as a conceptual framework. *Diagnosis (Berl)*, 2020. 7(3): p. 241–249.
28. King, A., From Sage on the Stage to Guide on the Side. *College Teaching*, 1993. 41(1): p. 30–35.
29. Rees, E.L., et al., How does peer teaching compare to faculty teaching? A systematic review and meta-analysis. *Med Teach*, 2016. 38(8): p. 829–37.
30. Mishra, P. and M.J. Koehler, Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record: The Voice of Scholarship in Education*, 2006. 108: p. 1017 – 1054.
31. Sandars, J., The use of reflection in medical education: AMEE Guide No. 44. *Med Teach*, 2009. 31(8): p. 685–95.
32. Aronson, L., Twelve tips for teaching reflection at all levels of medical education. *Med Teach*, 2011. 33(3): p. 200–5.
33. Remesh, A., Microteaching, an efficient technique for learning effective teaching. *J Res Med Sci*, 2013. 18(2): p. 158–63.
34. Korthagen, F. and A. Vasalos, Levels in reflection: core reflection as a means to enhance professional growth. *Teachers and Teaching*, 2005. 11(1): p. 47–71.
35. de la Croix, A. and M. Veen, The reflective zombie: Problematizing the conceptual framework of reflection in medical education. *Perspect Med Educ*, 2018. 7(6): p. 394–400.
36. Sullivan, P.B., et al., Peer observation of teaching as a faculty development tool. *BMC Med Educ*, 2012. 12: p. 26.
37. Dolmans, D.H. and C.P. van der Vleuten, Research in medical education: practical impact on medical training and future challenges. *GMS Z Med Ausbild*, 2010. 27(2): p. Doc34.
38. Blanchard, R.D., A.R. Artino, Jr., and P.F. Visintainer, Applying Clinical Research Skills to Conduct Education Research: Important Recommendations for Success. *J Grad Med Educ*, 2014. 6(4): p. 619–22.
39. Blanchard, R.D., P.F. Visintainer, and J. La Rochelle, Cultivating Medical Education Research Mentorship as a Pathway Towards High Quality Medical Education Research. *J Gen Intern Med*, 2015. 30(9): p. 1359–62.
40. Yu, T.C., et al., Medical students–as–teachers: a systematic review of peer–assisted teaching during medical school. *Adv Med Educ Pract*, 2011. 2: p. 157–72.
41. Dhaese, S., et al., Student participation: To the benefit of both the student and the faculty. *Education for Health*, 2015. 28(1): p. 79–82.
42. Franzenburg, G., Educational Intervention: Theory and practice. *Problems of education in the 21st century. PEC*, 2009. p.37–43