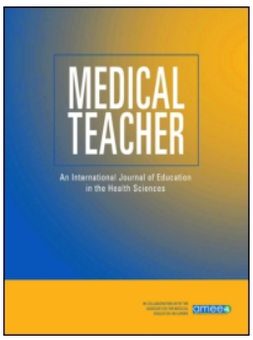

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Ten key features of the future medical school—not an impossible dream

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ABSTRACT

Significant developments in medical education are necessary if medical schools are to respond to the pressures from advances in medicine, changes in health care delivery, and patient and public expectations. This article describes 10 key features of the medical school of the future: the move from the ivory tower to the real world, from just-in-case learning to just-in-time learning, from the basic science clinical divide to full integration, from undervalued teaching and the teacher to recognition of their importance, from the student as a client to the student as partner, from a mystery tour to a mapped journey, from standard uniform practice to an adaptive curriculum, from a failure to exploit learning technology to its effective and creative use, from assessment *of* learning to assessment *for* learning, and from working in isolation to greater collaboration. A move in the directions specified is necessary and possible. With some of the changes proposed already happening, it is not an impossible dream.

Concern has been expressed that the medical curriculum has not responded adequately to advances in medical sciences, to changes in medical practice, and to patient and public expectations. Frenk et al. (2010) in the much quoted report in the Lancet argued "Professional education has not kept pace with these challenges, largely because of fragmented, outdated, and static curricula that produce ill-equipped graduates." Concern has also been expressed about higher education more generally and Christensen and Eyring (2011) argued that "the typical university must change more quickly and more fundamentally than it has been doing."

Many of the changes in medical education that have taken place have been relatively superficial or even cosmetic or have restricted their focus to one aspect of the education program. Understandably many have reflected power relationships between the different stakeholders and have been responses to vocal advocates for issues such as greater diversity and inclusion, the need for more family physicians, the use of near future technology, and the need to address specific subject areas or disciplines.

This article attempts to take a broader perspective of the challenges facing medical education and proposes ten features of the medical school of the future. While these may not all be fully achieved in the short term, what is described is not some form of disguised science fiction or an "impossible dream" but an achievable representation of what the medical school of the future will look like. The suggestions are grounded on my personal experiences over the past sixty years as a student, a teacher, a dean, and an educational researcher, and on what has been published in the literature on the subject. Hess (2010) in his book *The Same Thing Over and Over* described "repeated attempts to improve a fundamentally outdated outmoded structure. Rather than explore and develop new structures, reformers pour their faith and resources into making the existing structure more effective. They tend to colour safely within the lines – largely because those lines are so taken for granted that would-be reformers don't realise that there is an alternative."

Practice points

- The status quo is not an option and every teacher has a responsibility to contribute to plans for the future direction of their school
- The 10 continua presented can be used as a tool to evaluate where your school is at present in planning for the future and in which direction it would like to progress
- When planning for the future, think creatively and "colour outside the lines"

In this paper, I have attempted to "colour outside the lines" and describe what the medical school of the future could look like if it is to meet the current and future challenges relating to how we train our doctors. The space available does not allow me to do justice to each of the ten features described and each merits separate consideration in its own right.

From the ivory tower to the real world and the authentic curriculum

The first and arguably the most important feature of the medical school of the future will be that it will have an authentic curriculum with its priority the graduation of doctors who have the necessary knowledge, skills, and attitudes to meet the needs of the population they will serve. This purpose will be clearly delivered through an outcome- or competency-based approach (Harden et al. 1999). Each course and learning opportunity will specify how they contribute to the overall exit learning outcomes for the school.

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Students' progression will be planned to allow them to develop their professional identity and to take increasing clinical responsibility for the care of patients, serving in their final year as a student doctor. The authentic curriculum will be reflected in the learning environment which will support the student's professional development and wellbeing.

The school of the future will be accountable for its graduates, not just at the point of graduation but six months or years later. In a recent court case where a nurse was on trial for her role in the death of a patient, the judge on finding her guilty of the charge also held responsible for the nurse's actions the school where the nurse had been trained.

The characteristics of the doctors we are training will change over time reflecting the needs of the health system. This may evolve based on the doctors we know today or there may be a fundamentally different approach with some doctors training from entry to medical studies as a specialist with an accelerated curriculum while others will have a more extended curriculum qualifying as a generalist or diagnostician responsible for referring the patient to the appropriate therapist. As argued at an AMEE 2016 symposium this approach offers major advantages in reducing the cost of medical training and at the same time delivering the highest quality of care.

Moving from just-in-case to just-in-time learning

A fundamental difference in the medical school of the future will be a move from "just-in-case" learning to "just-in-time" learning. At present too much emphasis is placed on the student or trainee learning and memorizing all they need to know as a doctor. This leads to information and cognitive overload and is not tenable with more than 60,000 possible diagnoses and more than 6000 interventions and with medical knowledge doubling every eighteen months or less.

A mastery of the vocabulary of medicine, core knowledge and threshold concepts and an awareness of the possibilities in medicine, as described in the first level of the knowledge pyramid (Harden and Lilley 2018), will continue to be important but as important will be the doctor's ability to ask the right question when they need to know something, to know where to look for the answer and to evaluate the answers received (Friedman et al. 2016). The medical school of the future will see a switch from the teacher as an information provider to one of information coach where the student is supported in finding information when they require it (Harden and Lilley 2018).

This change from the concept of "just-in-case" learning to "just-in-time" learning will require a significant change of culture in the medical school of the future, reflected in the expected learning outcomes, the lectures and other learning opportunities, and the assessments.

From a basic science clinical divide to full integration of the basic sciences with clinical medicine

The need to move to a more vertically integrated education program was highlighted in the SPICES model of curriculum development (Harden et al. 1984) and has been a feature of recommendations of the UK General Medical Council and other accrediting bodies. Approaches at present, however, are often restricted to the provision for the student of limited clinical experiences in the early years and a token representation of the basic sciences in the later years. Professor Garland when Professor of Biochemistry at Dundee Medical School argued that students would be better placed to understand biochemistry after and not before their clinical experiences. We need to move higher up the integration ladder (Harden 2000). The school of the future will be at the top of the ladder with the emphasis on integration in the real world setting and students will commence their studies in a clinical setting as implemented in the Zucker School of Medicine at Hofstra/Northwell in the USA (Brenner et al. 2018).

Teaching and learning about the basic sciences will be integrated with the learning of clinical skills and practical procedures. In the later years, basic or foundational sciences will be embedded in the student learning and assessment.

From undervaluing of teaching to recognition of the importance of teaching and teachers

Excellence in a medical school in its education program is increasingly recognized but it is a message too frequently ignored by deans. Teachers are key to the success of an education program. In the medical school of the future, priority will be given to teaching and to the appointment, recognition, training, and reward of teachers. Teachers will be recognized for the key role they play. They will be familiar with and understand the different roles they may fulfill (Harden and Lilley 2018). All teachers will demonstrate elements of scholarship and will reflect on their own teaching, attempt to improve it where necessary, and engage in action research. As noted by Stenhouse (1975) "It is teachers who in the end will change the world of the school by understanding it." Research in education will not just be for teachers but by teachers with teachers as researchers and not just the researched. The future teachers will, as stakeholders, be active players in the development of the curriculum and the school's education program.

Teachers as professionals will keep themselves up-to-date with education methods through continuing staff development activities. The culture in the school will have changed to give staff development a higher priority in the hierarchy of the institution's needs and the program will be personalized and tailored to the needs and role of each teacher.

Rankings of schools in the future will recognize teaching as well as research and schools will aspire for excellence in teaching through the ASPIRE-to-Excellence initiative (ASPIRE-to-excellence.org) or some similar initiative.

A move from the student as a client to the student as a partner

The role of the student in the education program has changed from one of a client to a consumer and a partner in the learning process. Their role will continue to evolve and will include involvement with the management of the school and curriculum planning, with delivery of the education program and peer teaching, with the assessment program and with the selection process for student admission

to medical school. Students will be involved with the creation of learning resources and with assessment exercises to support independent and adaptive learning (Tackett et al. 2018a). Students in the school of the future will also be involved with staff appointment interviews and where this has been implemented, it has been found to give fresh and helpful insights. Student engagement in the education process is one of the current six ASPIRE-to-Excellence themes (Harden 2018).

In the school of the future there will be an adaptive curriculum with the pace, duration and strategies for each learner's experiences to be continuously adapted to their individual unique and evolving characteristics and readiness for learning (Jason and Westberg 2018).

Learning will be supported by digital study guides with each student having their own personal online learning assistant (POLA). The POLA will help the student to assess their achievement of the learning outcomes and will recommend appropriate learning opportunities. Supported by the POLA, students will take more responsibility for their learning, moving from directed self-learning to self-directed learning.

All students will receive training in education as part of the curriculum to equip them with educational knowledge, skills and understanding. This will allow them not only to play a meaningful active part in the education program but to contribute to research and publications in the field of medical education. Already we have seen a trend in this direction with the number of papers published in Medical Teacher where a student is a coauthor increasing from 3% in 2000 to 15% in 2017 (Harden et al. 2018).

A move from a mystery tour to a mapped journey

In the traditional curriculum, students studied each subject assuming and trusting that it would equip them for the subjects that were to follow and ultimately for their practice as a doctor. At present there is often only a camouflage relevance where a superficial reason is given for learning a topic with no real understanding provided of the learning path and the steps that lead to the students ultimate destination. This has been likened to a magical mystery tour where there is an absence of transparency as to the final destination and how study in one area contributes to an understanding of the next area.

In the school of the future there will be a multirelational curriculum map which shows the destinations (the learning outcomes) and how students might get there (the learning opportunities) (Harden 2001). Other windows in the map will indicate appropriate assessments, relevant courses or modules in the education program, and faculty responsibilities.

Using the map students will be able to chart their educational journey and progression on the journey and assess their own understanding and achievements at each stage. Students may visit a destination on a number of occasions as in a spiral curriculum (Harden and Stamper 1999), expanding their knowledge of the destination at each visit.

Curriculum maps prepared in the same way for the other health care professions will demonstrate the common destinations and what is expected of each health care professional at the destination. Also demonstrated will be where the journey and learning opportunities can be shared.

Progress to date with curriculum mapping has been slower than might have been expected due to difficulties in establishing collaborations between the key players including the content experts, the educationalists, and the technologists.

Advances in educational thinking including the move to outcome-based education and better collaboration between those involved will help to establish multidimensional curriculum maps as a key element and tool for the medical school of the future.

A move from a standard uniform program to an adaptive curriculum with adaptive learning

Health care professionals treat each patient as an individual who requires their own personal management plan. Some patients with hyperthyroidism, for example, may require drug therapy, others radioactive iodine or surgery depending on their personal condition. Personalized medicine is increasingly a feature of medical practice. Each student is also different but personalized education has until recently attracted less attention. I became acutely aware of the need to respond to students' individual needs when, as chair of the endocrine system course, I asked students to complete the end-of-course MCQ assessment on day one of the course. The range in the students' performance was great with some students scoring less than 5% and others over 45%. It was obvious that the needs of the students at the upper end were different from those at the lower end. There was a need to polish the diamonds but also smooth the pebbles. This led to the development of an independent learning program where students could work at their own pace testing their understanding as they proceeded (Harden et al. 1969). In the Carnegie Foundation report, *Educating Physicians*, one of the four recommendations for change in medical education in the USA is that greater options should be provided for individualizing the learning experience for students and residents (Cook et al. 2010).

There has been a growing appreciation that teaching and learning approaches should adapt to the learner's personal needs rather than as at present a situation where there is a uniform or standard approach and the student has to adapt to this (Jason and Westberg 2018).

The curriculum model in the school of the future will move from one where time is fixed and standards are variable to one where time to complete a course or element within it is variable and standards are fixed (Frank et al. 2017). This will recognize the need to respond to the increasing diversity of students admitted to study medicine.

The adaptive curriculum will be delivered at different levels of granularity, associated with the individual learning opportunities offered, modules or units within a course or the whole course. Experience in the simulation center, preparing for a flipped class session or listening to a recorded lecture will not be specified in minutes or hours but will depend on the time taken to achieve the learning outcomes specified for the activity. Students will be able to complete modules of the course at different rates and use the time made available when a module is completed early

to undertake additional electives and gain badges or certificates recognizing their additional achievements in the areas studied. A program which allows the learner to complete the course and qualify at different times is more difficult but nonetheless should be an aim. It has been demonstrated to be possible in postgraduate training in orthopedics where some surgeons completed the training after two years, while others required three or four years to achieve mastery of the skills and knowledge required (Ferguson et al. 2013).

The introduction of an adaptive curriculum will not be easy and will require different approaches to teaching and assessment (Tackett et al. 2018b).

A move from a failure to exploit fully learning technology to its creative and effective use

Technology has been increasingly used in education in the health professions. The tendency, however, has been to use it to do more effectively and efficiently what we are already doing. As suggested in *E-learning–caged bird or soaring eagle?* (Harden 2008), we need to plan more creatively the use of technology to support education changes without which the change would not be possible. Prensky (2013) argued "it's important to understand that technology isn't just a new way to do old things, which is mostly how we use it in schools today. That is, in fact, the most trivial use of technology." In the same issue of *Educational Leadership* devoted to the future of technology in education, Richardson (2013) quoted Neil Postman "Technological change is not additive: it is ecological, which means, it changes everything."

Over the past decade increasing use has been made of technology in education including e-learning, sophisticated simulations, and simpler audience response systems. The creative and meaningful use of technology will undoubtedly feature prominently in the school of the future and will make possible approaches such as adaptive learning as described above. In the introduction to the report by the Institute for Public Policy Research, *An avalanche is coming*, Barber et al. (2013), President Emeritus of Harvard University, suggested "just as globalisation and technology have transformed other huge sectors of the economy in the past 20 years, in the next 20 years universities face transformation."

Learning analytics will also play an important role in the medical school of the future (Menon et al. 2017). As argued by Ellaway et al. (2014) "health profession educators will need to be ready to deal with the complex and compelling dynamics and analytics of Big Data."

A move from compartmentalized assessment *of* learning to program-focused assessment *for* learning

Initiatives such as performance assessment, competency-based assessment, assessment *for* learning, programmatic assessment, and test-enhanced learning will underpin and feature prominently in the approach to assessment in the school of the future. The assessment will mirror the authentic curriculum ensuring that students have achieved the necessary competencies to function in the real world as a practitioner.

Decisions will be taken not on the results of single examinations at one point in time but using a program focused or programmatic approach based on an aggregation and analysis of evidence from different sources collected over time (Schuwirth and van der Vleuten 2011; van der Vleuten et al. 2015). The assessment of a student's communication skills, for example, will be based not just on their performance in communication stations in an OSCE but also on assessments by PBL tutors, clinical supervisors, other members of the health care team, patients and peers, and from their portfolios. Assessment will not only serve the purpose of determining whether the learner has achieved the required competencies and specified learning outcomes (assessment *of* learning) but will also guide the learner's studies (assessment *for* learning) and contribute to their learning (test enhanced learning) (Schuwirth and van der Vleuten 2011).

A detailed analysis of the ongoing assessment results will be relevant not only to the individual student but will also have an impact on decisions about the teaching and learning program and the curriculum more generally.

A move from working in relative isolation to greater collaboration

Collaboration will be an important feature of the school of the future––collaboration internally in the delivery of the school's education program, collaboration with other institutions, and collaboration across the different phases of education from undergraduate through postgraduate to continuing medical education.

In the medical school, collaboration between the teachers in the different phases of the curriculum will feature prominently with horizontal and vertical integration being more than just window dressing. There will also be a close contribution with all of the stakeholders including other professions, educationalists, technologists, and patients (Wilkinson 2018).

In the past learning has often been a solitary exercise. Students listen to a lecture and make their own notes and study with books or other aids on their own although to some extent collaboration occurred with problem-based learning. High levels of collaboration, a strong community with networking and peer-to-peer teaching will have an important part to play in the school of the future.

Collaboration will extend beyond the medical school involving other institutions nationally and internationally. The medical school of the future will be less self-sufficient and independent. In the delivery of its education program it will share with other schools nationally and internationally curricula, teachers, educational expertise, learning resources, and learning opportunities. Benefits will be achieved from unbundling or outsourcing elements of the education program. Craig (2015) documents the "great unbundling of higher education" and describes it as "a gripping vision of the likely immediate future of higher education, backed by hard data and insider insights." Such unbundling will allow cost savings and at the same time quality improvement (Gupta et al. 2005). It will allow a school to focus on its core activities where it is best and at the same time access additional experts and facilities. It

Table 1. Ten key features of the medical school of the future.

The past and present	The future
The Ivory Tower	The real world and the authentic curriculum
Just-in-case learning	Just-in-time learning
Basic science/clinical medicine divide	Basic sciences and clinical medicine integration
Teaching and teachers undervalued	Importance of teaching and teachers recognized
Student as a client	Student as a partner
A mystery tour	A mapped journey
Standard uniform program	Adaptive curriculum with adaptive learning
Failure to exploit technology	Creative use of technology
Compartmentalized assessment *of* learning	Program-focused assessment *for* learning
Working in isolation	Greater collaboration

will also be a catalyst for change and increase a capacity for innovation.

There will be a move away from the different phases of undergraduate, postgraduate and continuing education operating in isolation with little or no communication about educational strategies, learning outcomes, assessment, and finances. The curriculum in the school of the future will be part of an extended curriculum across the continuum with students' and trainees' progress charted on a curriculum map and recorded in a learning and assessment portfolio. Schools are already imaginatively looking at this continuum and identifying on entry to medical school a student's postgraduate placement, incorporating this into the curriculum.

Discussion

This article describes 10 ke2y features of the medical school of the future (Table 1). What is presented is not an impossible dream but a realistic picture that takes into account both the winds of change taking place in medical education and what is required if we are to provide an appropriate training for the doctor of the future. Indeed many examples can be found of schools on a path to develop elements of the approaches described.

The SPICES model has proved to be a useful tool for schools to assess their curricula on six dimensions and to decide where they are currently, and where they wish to be in the future on each continuum (Harden et al. 1999). The ten dimensions described for the future medical school provides a tool for a school to plan for their future development. As found with the SPICES model there is merit in inviting the various stakeholders including students, teachers, recent graduates, and patients to consider where the school is at present on each of the dimensions and where they wish to be one, five and ten years from now. The options for each dimension are not presented as binary decisions with views polarized for or against an approach but rather as a series of continua on which a school can progress now and over the years ahead.

It is likely that a move in the directions described will require a school to reconsider their current approach and to realign their priorities recognizing the importance of the education program and the changing role of students and teachers (Harden and Lilley 2018).

Without doubt a move in the directions proposed in this paper will not be without its difficulties. Obstacles to be overcome will include faculty resistance, lack of resources including time and students' concerns and apprehension particularly if there is a mismatch (which we hope there will not be) between their studies and a national final exam if one exists. The status quo, however, is not an option. Teachers and others with a commitment to education should not just wait for change to happen. They should be part of the process of creating an exciting vision for their own school of the future. As noted by Geurin (2017) "the best solutions aren't microwave friendly. They come through deeper thinking. They come by shifting perspective. Do the hard work of challenging the status quo. Ponder the deeper questions and look at the world in new and interesting ways."

Disclosure statement

The author reports no conflicts of interest. The author alone is responsible for the content and writing of this article.

Glossary

Adaptive curriculum: An adaptive curriculum is personalized to the individual student's needs in terms of pace, duration, and learning approaches.

Unbundling the curriculum: In an unbundled curriculum the school does not deliver its program in isolation but shares with other schools teachers, educational expertise, elements of the curriculum, learning resources, and assessments.

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References

Barber M, Donnelly K, Rizvi S. 2013. An avalanche is coming: higher education and the revolution ahead. London: IPPR.

Brenner J, Bird J, Ginzburg SB, Kwiatkowski T, Papasodero V, Rennie W, Schlegel E, ten Cate O, Willey JM. 2018. Trusting early learners with critical professional activities through emergency medical technician certification. Med Teach. 40:561–568.

Christensen CM, Eyring HJ. 2011. The innovative university. San Francisco (CA): Jossey-Bass.

Cook M, Irby D, O'Brien BC. 2010. Educating physicians. San Francisco (CA): Carnegie Foundation.

Craig R. 2015. College disrupted: the great unbundling of higher education. New York (NY): St Martin's Press.

Ellaway RH, Pusic MV, Galbraith RM, Cameron T. 2014. Developing the role of big data and analytics in health professional education. Med Teach. 36:216–222.

Ferguson PC, Kraemer W, Nousiainen M, Safir O, Sonnadara R, Alman B, Reznick R. 2013. Three-year experience with an innovative, modular competency-based curriculum for orthopaedic training. J Bone Joint Surg Am. 95:e166.

Frank JR, Snell L, Englander R, Holmboe ES. 2017. Implementing competency-based medical education: Moving forward. Med Teach. 39:568–573.

Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, Fineberg H, Garcia P, Ke Y, Kelley P. 2010. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet. 376:1923–1958.

Friedman CP, Donaldson KM, Vantsevich AV. 2016. Educating medical students in the era of ubiquitous information. Med Teach. 38:504–509.
Geurin D. 2017. Future driven: Will your students thrive in an unpredictable world? Bolivar (MO): David G Geurin.
Gupta A, Herath K, Mikouiza NC. 2005. Outsourcing in higher education: an empirical examination. IJEM. 19:396–412.
Harden RM, Crosby JR, Davis MH. 1999. Outcome-based education. AMEE Medical Education Guide No 14. Part 1. An introduction to outcome-based education. Med Teach. 21:7–14.
Harden RM, Lever R, Dunn WR, Lindsay A, Holroyd C, Wilson GM. 1969. An experiment involving substitution of tape/slide programmes for lectures. Lancet. 293:933–935.
Harden RM, Lilley PM. 2018. 8 roles of the medical teacher. London (UK): Elsevier.
Harden RM, Lilley PM, McLaughlin J. 2018. Forty years of medical education through the eyes of Medical Teacher: From chrysalis to butterfly. Med Teach. 40:328–330.
Harden RM, Sowden S, Dunn WR. 1984. Some educational strategies in curriculum development: the SPICES model. Med Educ. 18:284–297.
Harden RM, Stamper N. 1999. What is a spiral curriculum? Med Teach. 21:141–143.
Harden RM. 2018. Excellence in medical education – Can it be assessed? TAPS. 3:1–5.
Harden RM. 2000. The integration ladder: a tool for curriculum planning and evaluation. Med Educ. 34:551–557.
Harden RM. 2001. AMEE Guide No. 21: Curriculum mapping: a tool for transparent and authentic teaching and learning. Med Teach. 23:123–137.
Harden RM. 2008. E-learning – caged bird or soaring eagle? Med Teach. 30:1–4.
Hess FM. 2010. Same thing over and over: How school reformers get stuck in yesterday's ideas. Cambridge (MA): Harvard University Press.
Jason H, Westberg J. 2018. Preparing educators for adaptive education programmes. Med Teach. 40(8). DOI:10.1080/0142159X.2018.1487049
Menon A, Gaglani S, Haynes MR, Tackett S. 2017. Using "big data" to guide implementation of a web and mobile adaptive learning platform for medical students. Med Teach. 39:975–980.
Prensky M. 2013. Our brains extended. Educ Leadership. 70:22–27.
Richardson W. 2013. Students first, not stuff. Educ Leadership. 70:10–14.
Schuwirth LWT, van der Vleuten CPM. 2011. Programmatic assessment: From assessment of learning to assessment for learning. Med Teach. 33:478–485.
Stenhouse L. 1975. An introduction to curriculum research and development. Newcastle: Heinemann Educational Books.
Tackett S, Raymond M, Desai R, Haist S, Morales A, Gaglani S, et al. 2018a. Crowdsourcing for assessment items to support adaptive learning. Med Teach. 40. DOI:10.1080/0142159X.2018.1490704
Tackett S, Wright S, Quirk M. 2018b. Adaptive medical education research. Med Teach. DOI:10.1080/0142159X.2018.1490705.
Van Der Vleuten CPM, Schuwirth LWT, Driessen EW, Govaerts MJB, Heeneman S. 2015. Twelve tips for programmatic assessment. Med Teach. 37:641–646.
Wilkinson E. 2018. The patients who decide what makes a good doctor. BMJ. 361:1–3.