Music lessons: revealing medicine's learning culture through a comparison with that of music

Christopher Watling,[1] Erik Driessen,[2] Cees P M van der Vleuten,[2] Meredith Vanstone[3] & Lorelei Lingard[4]

CONTEXT Research on medical learning has tended to focus on the individual learner, but a sufficient understanding of the learning process requires that attention also be paid to the essential influence of the cultural context within which learning takes place. In this study, we undertook a comparative examination of two learning cultures – those of music and medicine – in order to unearth assumptions about learning that are taken for granted within the medical culture.

METHODS We used a constructivist grounded theory approach to explore experiences of learning within the two cultures. We conducted nine focus groups (two with medical students, three with residents, four with music students) and four individual interviews (with one clinician-educator, one music educator and two doctor-musicians), for a total of 37 participants. Analysis occurred alongside and informed data collection. Themes were identified iteratively using constant comparisons.

RESULTS Cultural perspectives diverged in terms of *where* learning should occur, *what* learning outcomes are desired, and *how* learning is best facilitated. Whereas medicine valued *learning by doing*, music valued *learning by lesson*. Whereas medical learners aimed for competence, music students aimed instead for ever-better performance. Whereas medical learners valued their teachers for their clinical skills more than for their teaching abilities, the opposite was true in music, in which teachers' instructional skills were paramount. Self-assessment challenged learners in both cultures, but medical learners viewed self-assessment as a skill they could develop, whereas music students recognised that external feedback would always be required.

CONCLUSIONS This comparative analysis reveals that medicine and music make culturally distinct assumptions about teaching and learning. The contrasts between the two cultures illuminate potential vulnerabilities in the medical learning culture, including the risks inherent in its competence-focused approach and the constraints it places on its own teachers. By highlighting these vulnerabilities, we provide a stimulus for reimagining and renewing medicine's educational practices.

Medical Education 2013: ***47:*** *842–850*
doi: 10.1111/medu.12235

Discuss ideas arising from the article at www.meduedu.com 'discuss'

[1]Department of Clinic Neurological Sciences, Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ontario, Canada
[2]Department of Education Development and Research, Maastricht University, Maastricht, the Netherlands
[3]Centre for Health Economics and Policy Analysis, McMaster University, Hamilton, Ontario, Canada
[4]Department of Medicine, Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ontario, Canada

Correspondence: Dr Christopher Watling, Associate Dean, Postgraduate Medical Education, Schulich School of Medicine and Dentistry, Medical Sciences Building Room M103, University of Western Ontario, London, Ontario N6A 5C1, Canada.
Tel: 00 1 519 661 2019;
E-mail: chris.watling@schulich.uwo.ca

INTRODUCTION

Calls abound for improved educational experiences that will prepare tomorrow's doctors to practise in dynamic environments.[1–4] A necessary precursor to such improvements is a clear understanding of exactly how learning currently occurs in medicine. Medical learning is sometimes portrayed as an individual journey and some researchers favour a distinctly cognitivist approach that focuses on how individual learners navigate and interpret clinical experiences.[5–7] Increasingly, however, medical education researchers are recognising the limitations of this cognitivist approach, and are gaining useful insights by examining learning from a socio-cultural perspective.[8–11] This perspective views learning activities as inseparable from the context in which they take place; learning is viewed not as an individual mental construction, but as a process of participation in the social and cultural practices of a community.[12,13] A sufficient understanding of how learning occurs in medicine therefore demands that attention be paid not only to the individual learner, but also to the professional culture that forms the backdrop and context for learning.

The focus of this study is on *learning culture*, a term that embraces the pedagogical approaches that are routine within a profession or discipline, and perhaps so deeply ingrained that we may fail to recognise them as deliberate educational choices.[14] A learning culture may be difficult to see from within because it involves tacit knowledge and assumptions that are taken for granted. One approach to making the tacit explicit is to compare one learning culture with another. The use of comparison may facilitate the identifying of those pedagogical approaches that, rather than being generic educational strategies, are actually distinct features of a particular learning culture.

In this study, we explored learners' perspectives within two different professional cultures: medicine and music. We chose music as a comparator with medicine for both its shared features and its anticipated differences. Music and medicine both train individuals to perform by engaging specialised skills in specific settings. We anticipated, however, that both the process of learning to perform and the very nature of the performance goals would prove to be sufficiently distinct to provide meaningful insights. Consider, for example, the performance of an operatic aria on a concert stage alongside the performance of a laparoscopic cholecystectomy in an operating theatre: they are vastly different performances, certainly, but both are products of systematic processes of teaching and learning. We thought that music was a particularly rich comparator for medicine because, like medicine, it has relied on a set of pedagogical strategies that are remarkably similar across institutions. Also as in medicine, these strategies have come under scrutiny as the role of music in society has evolved.[15] Our aim was to use this comparative approach to unearth assumptions about learning that are taken for granted within the medical culture, to explore the influences these assumptions have on learning, and to consider the implications of these assumptions for medical learning.

METHODS

We used a constructivist grounded theory approach in this exploration of learning cultures. The constructivist paradigm views knowledge as actively created through human interactions and relationships, and demands that the vantage points of both participants and researchers be accounted for as data are collected and interpreted.[16] Because a constructivist research process is one of active engagement, in which researchers bring their own backgrounds and assumptions to the analytic process, reflexivity is critical.[17] Researchers must both reflect on how their own backgrounds might influence their approaches to the subject and share these reflections with readers to facilitate the meaningful interpretation of the work. In this reflexive spirit, we provide the following contextual information: the lead author (CW) is a doctor; his collaborators have significant experience in studying medical education, but their own disciplinary backgrounds are non-medical and include education (ED), psychology and psychometrics (CvdV), qualitative health research (MV) and rhetoric (LL). Two researchers (CW and LL) have also had significant training in music.

Purposive sampling of learners within medicine and music was employed. All participants were recruited from a single Canadian university. In this sampling strategy, researchers purposefully select sources of data they consider likely to provide rich information relevant to their research questions.[18] As we wished to explore the learning cultures of music and medicine, we invited undergraduate music students, senior medical students, and residents in a variety

of disciplines to participate. Initial contact was made via an e-mail invitation. Because music students need to have a significant musical background – typically several years of training – in order to be accepted into an undergraduate programme, we reasoned that undergraduate students would already be sufficiently acquainted with the professional culture of music to inform our research. Medical students, by contrast, often enter medical school with no prior experience in medical settings. We therefore included both medical students and residents in our sample, anticipating that perspectives might vary depending on learners' level of training and the extent to which they had become part of the professional culture. The study received the approval of the university's research ethics board and all participants provided informed consent.

Thirty-three learners (eight medical students, 12 residents, 13 music students) participated in semi-structured focus group discussions of 60–90 minutes in duration. We conducted two medical student focus groups, three resident focus groups and four music student focus groups. We decided to employ homogeneous focus groups rather than combining learners from medicine and music within the same focus group for two reasons. Firstly, we wanted participants to freely use the language of their respective training culture, and reasoned that focus group time would be spent more efficiently if group members did not need to repeatedly explain and clarify their jargon and the patterns and conventions of their training to one another. Secondly, we wanted to ensure that one culture did not dominate the other and thus limit the richness of the cultural perspective we sought to elaborate. As researchers with medical education backgrounds, we wished in particular to ensure that music students would have the opportunity to discuss their training culture without competing with medical learners. The size of each focus group (three to five individuals per group) was smaller than we had targeted, and reflected scheduling challenges rather than a deliberate design decision. To further enrich the data, we also conducted four individual interviews based on purposive sampling of individuals whom we anticipated might illuminate our developing notions about professional culture; these key informants included one clinician-educator, one music educator, and two doctors with extensive musical training. Focus groups and interviews were semi-structured, guided by probes designed to elicit discussion and elaboration of key aspects of the experience of learning within a particular disciplinary culture. Focus group discussions and interviews were recorded and transcribed verbatim without identifying information.

Data were analysed using the constant comparative approach customary in grounded theory.[17] By reading and examining the incidents, experiences and perspectives our participants described, we identified thematic categories within the data; the process of comparing incident with incident and experience with experience defined the breadth and characteristics of these categories. Particular attention was paid to discrepant examples to ensure that the analysis could account for their occurrence. The process was iterative, with analysis occurring alongside and informing data collection: themes that we identified in our examination of initial transcripts were explored in more depth in subsequent focus groups and interviews using new probes.

Coding, the process of organising our data into key conceptual categories or themes, was carried out primarily by two researchers (CW and MV). Working independently initially, these two researchers carefully examined several transcripts and developed preliminary coding structures for organising the data thematically. They then met to compare and discuss their coding approaches, reaching consensus on a robust coding system, the categories of which were clearly delineated. The evolving coding scheme was periodically discussed with the entire research team to further enhance the rigour of the process. Consistent with our grounded theory approach, we employed theoretical sampling, continuing data collection until thematic saturation was achieved.[18,19] Saturation does not mean that no new ideas would have been identified with additional data collection; rather, it implies the collection of sufficient data to enable an adequate understanding of the dimensions and properties of our key concepts.[19] Once the coding scheme had been refined, relationships among categories were explored to facilitate raising the analytic level from the merely categorical to the conceptual in order to render the data analysis more meaningful.

RESULTS

Although our analysis revealed some common ground between the two professional cultures, this report will focus on the contrasts between the cultures as it is these contrasts that highlight the taken-for-granted assumptions in medicine that we wish to examine. Our analysis revealed striking contrasts in how the two learning cultures

addressed three fundamental questions: (i) *Where* does learning occur most effectively? (ii) *What* learning outcomes are desired? (iii) *How* is learning best facilitated? These overarching questions appeared to direct how a learning culture defined itself. In keeping with our analytical goal of conceptual insights, we will not present results in terms of thematic categories and subcategories. Rather, we will elaborate the contrasts in how the two cultures approached these defining questions, illustrating our analysis with representative quotations from participants.

Where does learning occur?

Whereas medicine valued *learning by doing*, music valued *learning by lesson*, and these defining values influenced the contexts in which each culture located its learning experiences. Medical learners consistently identified opportunities to actively participate in clinical work as central to their learning. As one medical student noted:

> 'We learn by being thrown into the fire… dealing with patients on your own.' (Medical student 8, FG 2)

Similarly, a medical educator observed:

> '…in our culture there is an idea that you learn by your mistakes… Feedback is not viewed as being as important… because there is also an idea that you'll learn it on your own.' (Clinician-educator)

Medical learning was workplace-based and experiential, with the majority of learner time consumed with the actual performance of the tasks of the job.

Experiential learning, by contrast, was not explicitly valued by music students. Rather than the workplace or the concert stage, the core learning venues for music students were individual lessons and practice rooms. These lessons held a central place in the educational life of a music student:

> 'They have either an hour or an hour and a half lesson a week so that's one-on-one time… it's pretty intense when you see the students longitudinally for 4 years or plus if they continue on to graduate work.' (Music educator)

Music students dismissed the notion that they could learn simply by doing:

> 'I think if I were to just perform a piece without any teacher helping… I probably would not get very far on it because there's no motivation to keep pushing myself forward. Because when you have a teacher you kind of have a deadline, like by this week you have to get this much done.' (Music student 3, FG 6)

For music students, lessons directed, motivated and maintained the pace of learning.

What learning outcomes are desired?

Whereas medical learners identified competence as their goal, music students viewed competence as a distinctly unsatisfactory learning outcome. A doctor with musical training noted:

> '…in medicine I was most concerned about competency, so I really wanted to be able to do everything right… [but in music] it's sort of more than competency… you want to be *good*.' (Doctor-musician 1)

Medical learners viewed competence as something to be achieved by the end of training, in order that they could take their places as safe practitioners:

> '…we have a certain number of years by which we need to really improve ourselves, and make ourselves competent to go out independently and not make mistakes.' (Resident 1, FG 3)

Whereas the notion of 'going out independently' resonated among medical learners, this distinct separation of the learning phase and the professional phase of one's career was not as apparent in music. The need for lessons and coaching was viewed as career-long in music, as illustrated by this music student's comments:

> 'If you're hired at an opera company, you're not going to be learning the score by yourself and just performing it, you're going to be working with coaches, directors… You're always in that process of learning from other people and having that community of a team to help you to that performance. That will never go away.' (Music student 1, FG 6)

There were no similar comments that identified the need for career-long coaching from the medical learners we interviewed, raising the possibility that medical learners may consider their learning to be complete once competence is achieved. For learners in music, however, there was no 'good enough':

> 'It's not like, when you reach a certain age and you're a virtuoso it's like, "I'm done, I've achieved everything I need to achieve as a musician." That's why we all stick to it because there's no limit, because all the greats that we know of are still practising their ass off. You always have to keep working… You can never obtain perfection.' (Music student 4, FG 7)

Music students' apparent rejection of competence as an appropriate learning goal may reflect the values of a profession in which competent performance is not rewarded; success requires performance that stands out.

How is learning best facilitated?

The role of teachers

Although teachers play key roles in both cultures, the nature of these roles appeared distinct. Within medicine, a teacher's credibility depended more on clinical skill than on teaching ability, as this medical student's comments illustrate:

> 'I think that their clinical ability is… a greater predictor of how I would perceive their feedback, because if I see somebody making mistakes all the time or [doing] things I disagree with… I'm not going to buy their feedback as much, even if they are a brilliant teacher.' (Medical student 2, FG 1)

Teaching ability was undoubtedly valued; one medical student admitted:

> 'In a perfect situation we'd have somebody who is competent in both areas.' (Medical student 1, FG 1)

It was, however, from teachers able to expertly perform the tasks of the doctor that learners perceived they had the most to gain. Not surprisingly, role-modelling was often identified as an important facilitator of learning in medicine:

> 'I think role-modelling, seeing how they interact with their team and the discussions they have with the residents or nurses. Also seeing… what level the thought process is on, even if you're not necessarily included in it.' (Medical student 8, FG 2)

This learner valued the opportunity to observe expert performance, even without personal engagement in the event.

The credibility afforded to expert clinicians in medicine contrasted sharply with the bestowal of credibility in music, in which learners sought instructional expertise over performance expertise and described role-modelling as distinctly insufficient for learning:

> 'A teacher doesn't have to be a big superstar performer… I think it's more important that they know how to teach than just play. Because… you can just get a CD if you really want to hear [great] playing.' (Music student 3, FG 6)

Music teachers may be called upon to capably demonstrate aspects of performance, but this demonstration must be followed by detailed, meaningful instruction that helps the student understand how the performance is to be created. Distinct to music was the notion that a teacher's virtuosity as a performer might actually have a detrimental effect on his or her teaching capacity:

> 'When you're struggling with something and they're amazing, so good, and for them it's such an easy thing… they can't really comprehend why you're not getting it, so it kind of works better when they're not amazing concert pianists because they understand where you're coming from and what mistakes you're making.' (Music student 9, FG 8)

A critical notion in music was that performing and teaching involved related but largely separate skill sets; learners could readily distinguish great teachers from great performers:

> 'My piano teacher and my previous clarinet teacher were practising musicians… and they were great performers, but they could not give me the direction that I needed. They're not developed as teachers but they're great performers.' (Music student 1, FG 6)

In medicine, the distinction was much less clearly defined; medical learners gravitated toward the best clinicians as they sought to build their own skills, even as they recognised that not all expert performers were skilled teachers.

The role of observation

Participants from both cultures claimed feedback from their teachers was essential to learning. Only medical learners, however, struggled with the issue of feedback that they considered to be compromised in credibility by a lack of observation of the

learner's performance. One medical student noted:

> '…I saw patients on my own and I was never observed in my interviews but I got feedback on my interviewing skills… I thought that was useless feedback.' (Medical student 7, FG 2)

This issue was conspicuously absent from the music student data, perhaps because observation of music students' performance was near-continuous:

> 'I think we have feedback pretty much every day… You get used to people criticising you and watching you all the time and you don't really think about it.' (Music student 9, FG 8)

Although observation of their performance by teachers barely registered with music students because of its ubiquity, the sporadic nature of their own observation attracted the attention of medical learners, whose perspectives on observation were complex. On one hand, learners valued feedback informed by observation, as in this example from a resident on a psychiatry rotation:

> 'She sat me down at the end and we talked for quite a while about the evaluation, but it actually had meaning because what she was saying she could back up because she'd seen me all the time… It was psych, so they watch; they know.' (Resident 6, FG 4)

The equating of *watching* with *knowing* is a powerful comment on the value of observation as a component of the credibility of teacher feedback. On the other hand, medical learners were acutely aware that their teachers had other responsibilities besides teaching that constrained their capacity to observe:

> 'In medicine, your supervisor may be seeing patients on his or her own while expecting you to do the same thing and then only having a short time to interact.' (Medical student 5, FG 2)

Although learners acknowledged that the clinical setting might not permit extended observation, the consequences of the lack of observation were clear, as illustrated by this resident's comments:

> 'It's pretty typical that you'll have a busy consultant and a few things happening at once. They'll pick up 10 seconds of a 5-minute thing and tell you something about the 10 seconds when it's not really applicable if they were watching the whole 5 minutes.' (Resident 8, FG 4)

For music students, this particular aspect of feedback's credibility was never in question; medicine's practice of providing feedback on unobserved performance had no parallel in the learning culture of music.

The role of self-assessment

Within both fields, learners not only recognised the inherent value of self-assessment, but also acknowledged its limitations. Medical learners, however, tended to view self-assessment as an essential element of professionalism:

> '… it's really important to know when you're not equipped to do something, like that you're not competent to do something, and be able to ask for help or refer it on or whatever.' (Doctor-musician 1)

Although many medical learners acknowledged that they were not confident in their ability to self-assess, they viewed self-assessment as an essential skill to be developed:

> 'People are terrible at it but it's very important to be able to improve that skill.' (Medical student 1, FG 1)

Music students, despite recognising the potential usefulness of self-assessment, were more inclined to identify fundamental barriers to its routine use, as this singer noted:

> 'Your voice sounds completely different in your head than it sounds to everyone else.' (Music student 8, FG 7)

Music students viewed the perspective of their teacher as not just desirable but necessary:

> '…what you hear to yourself doesn't project out into the audience, so your teacher's feedback is extremely important.' (Music student 10, FG 8)

In addition, music students identified deliberate strategies for overcoming the inherent inaccuracy of self-assessment, such as 'record[ing] ourselves, over and over' (Music student 12, FG 9), suggesting the possibility that the professional value most strongly associated with self-assessment by musicians referred less to engaging in it, but. rather, to know-

ing it to be implicitly flawed and to require supplementing.

DISCUSSION

Our analysis provides insight into some of the routine practices and fundamental assumptions of two distinct learning cultures. Music is a culture in which learning occurs through extended, methodical, one-to-one instruction, in which practice counts more than performance in terms of learning progress and in which the goal of transcendent performance is rarely reached. Teachers are central figures who are certainly valued for their own musical abilities, but are valued even more highly for their instructional skills. Medicine, by contrast, is a culture in which learning by doing is privileged over learning by lesson. Notwithstanding an increasing emphasis in medicine on the creation of opportunities, such as those provided by simulation, that allow for the rehearsal of skills, the progress of medical learners remains founded less on practice and more on the performance of actual tasks of the profession. As medical learners move toward the goal of competent and safe practice, they rely on role models to steer them toward their desired professional identity. Medical teachers are valued when they display effective instructional skills, but it is their performances as clinicians that resonate most strongly with learners.

These conceptual insights from our analysis may be usefully considered in light of Shulman's concept of signature pedagogies, which provides a framework for examining and learning from such divergent educational practices.[14]Signature pedagogies are the characteristic forms of teaching and learning that occur within professions.[14,15] Signature pedagogies are 'windows into the cultures of their fields that reveal professional values',[20] reflecting and defining what counts as knowledge, how things become known, and how knowledge is critiqued and either accepted or discarded.[14] Shulman argues that signature pedagogies survive because they make for efficient learning, but cautions that they also distort learning, highlighting certain learning outcomes, but failing to support others.[21] As a result, signature pedagogies require periodic repair, for which comparison with other approaches to teaching and learning can provide a stimulus.[21] Indeed, this comparative approach has provided important insights in fields as diverse as law,[22] the liberal arts,[23] and education research,[20] suggesting that elements from one signature pedagogy might be strategically borrowed by another to enhance learning.

The essential periodic renewal and 'repair' of signature pedagogies is particularly pressing when changes occur in the way that a profession is practised.[14] Fundamental changes in medical practice, including the move toward ambulatory care-based practices, the sharpening focus on patient safety and social accountability, and the decrease in acceptable learner duty hours, make the reconsideration of its signature pedagogy especially timely.[14] As new visions emerge of the skills that tomorrow's doctors will require,[2–4] the learning environment necessary to produce doctors with those skills must be urgently reimagined.

How can our comparison with the learning culture of music inform this reimagining? The contrasts between the two cultures highlight some of the fundamental values underlying medical education practices, and expose what these practices do not address. Medicine's conceptualisation of performance in terms of competence is, in many ways, a strength of its learning culture; a vital social good is achieved when learners aim for safe, consistent and reproducible performance of the essential tasks of the profession. Defining medical performance in terms of competencies may therefore be considered a productive response to growing demands for the profession to be socially accountable, to reduce errors and to orient itself toward patient safety. The structuring of curriculum and assessment around competencies makes it unsurprising that achieving competence becomes a central goal for learners. As we embrace competency-based education in medicine, however, it is imperative that we consider the potential for unintended consequences.

Our comparison with music, a discipline that clearly does not define performance in terms of competence, offers a particularly useful perspective from which to consider the hazards of using competence as the sole framework for performance. In music, the need to aim for ever-higher levels of performance creates comfort among musicians with notions of lifelong learning and career-long coaching. By contrast, medicine's emphasis on competence as the defining feature of desired performance might inadvertently limit doctors' engagement in meaningful, career-long learning. Doctors would benefit if medicine's learning culture could more fully support learning beyond competence, and if the language of lifelong learning shifted its emphasis from the 'maintaining of competence' to the 'pursuing of excellence'. Medicine is beginning, in fact, to

recognise the potential value of adopting educational strategies common in other fields. The use of coaching, for example, is gaining favour in medicine, and has the potential to ensure that lifelong learning is not guided entirely by potentially flawed self-assessment,[24] but, rather, is supplemented by the periodic guidance of a trusted teacher or mentor.[25,26] The notion that an autonomous professional might benefit from a coach causes distinct discomfort within medicine, however.[27] Much can be learned from music, the learning culture of which not only normalises the use of coaching throughout a professional career, but expects it.

Our comparative analysis also raises questions about whether medicine's learning culture is constraining its own teachers from making meaningful contributions to learners' development. The paucity of opportunities for medical learners to develop trusting longitudinal relationships with teachers contrasts starkly with opportunities in music's learning culture, in which such relationships are considered paramount for effective professional development.[28] Building such relationships may facilitate the exchange of challenging feedback in a way that learners are more likely to accept,[29] and enable it to be framed as a meaningful dialogue on performance rather than as a simple transmission of information.[30] Instruction and feedback to medical learners are often poorly informed by direct observation of learner performance, whereas in music the provision of feedback without direct observation of performance is inconceivable. Medicine's culture of limited observation may support its values of independence and autonomy, but it does not address learners' need for credible feedback. In fact, the scarcity of observation in medicine routinely compromises the credibility of the feedback offered to learners, which may, in turn, lead to the discarding of that feedback.[8] Although lack of time is frequently offered as an explanation for the lack of direct observation of clinical learners, recent years have seen significant and time-intensive enhancements to clinical curricula, especially at the residency level, largely in response to evolving standards of accreditation. That programmes have been able to carve out several hours of time each week in which their learners can engage in academic activities amply demonstrates that change is possible; what is needed to more fully embed observation in our teaching practices is the will to do so. Finally, if medicine is to move successfully toward more efficient education, attention must turn toward the instructional capabilities of its teachers. Music holds instructional skill in high esteem, recognising that its best performers are not necessarily its strongest teachers. Medicine must recognise that it is insufficient to simply provide examples of desired performance; its teachers must also possess the instructional skills necessary to guide learners to develop similar standards of performance.

This study is limited by its single-centre, Canadian context. Furthermore, there are subcultures within the domains we studied that we were unable to attend to, given the relatively small number of learners participating in this study. Observation of learners is more widely employed in some medical fields than others, for example. Although our interview and focus group methods allowed us to engage directly with learners, observational methods typical of ethnographic research would have provided additional dimensions to our view of these two cultures. Future research should examine how specific aspects of teaching and learning, such as the giving and receiving of feedback, are influenced by professional culture, how individual and cultural influences on medical learning interact, and how the underlying values revealed by our pedagogical practices determine how learners construct meaning from their educational experiences.

Contributors: CW was responsible for the study design, participated in data collection, led the analytic process, and wrote all drafts of the manuscript. CW had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. ED and CvdV contributed ideas to the study design, participated in the analytic process through an iterative process of discussion, read all manuscript drafts, and offered suggestions for revisions. MV participated in data collection by conducting some of the focus groups and interviews, participated in the processes of data coding and analysis, and offered suggestions on the manuscript drafts. LL contributed ideas to the study design, participated in the data analysis through an iterative process of discussion, read all drafts of the manuscript, and offered suggestions for revisions. All authors approved the final version of the manuscript for submission.
Acknowledgements: none.
Funding: Medical Council of Canada Medical Education Research Grant.
Conflicts of interest: none.
Ethical approval: this study was approved by the Research Ethics Board of the University of Western Ontario, London, Ontario, Canada.

REFERENCES

1 Medical education and professionalism. *Lancet* 2009;**373** (9668):980.

2 Association of Faculties of Medicine of Canada. The future of medical education in Canada: a collective vision for MD education. http://www.afmc.ca/future-of-medical-education-in-canada/medical-doctor-project/pdf/collective_vision.pdf. [Accessed 8 August 2012.]
3 Association of Faculties of Medicine of Canada. The future of medical education in Canada: a collective vision for postgraduate medical education. http://www.afmc.ca/future-of-medical-education-in-canada/postgraduate-project/pdf/FMEC_PG_Public_Report-FINAL_EN.pdf. [Accessed 8 August 2012.]
4 American Medical Association. The AMA initiative to transform medical education: recommendations for change in the system of medical education. June 2007. http://www.ama-assn.org/resources/doc/council-on-med-ed/itme-final.pdf. [Accessed 5 September 2012.]
5 Teunissen PW, Scheele F, Scherpbier AJJA, van der Vleuten CPM, Boor K, van Luijk SJ, van Diemen-Steenvorde RAAM. How residents learn: qualitative evidence for the pivotal role of clinical activities. *Med Educ* 2007;**41**:763–70.
6 Teunissen PW, Boor K, Scherpbier AJJA, van der Vleuten CPM, van Diemen-Steenvorde JAAM, van Luijk SJ, Scheele F. Attending doctors' perspectives on how residents learn. *Med Educ* 2007;**41**:1050–8.
7 Watling C, Driessen E, van der Vleuten CPM, Lingard L. Learning from clinical work: the roles of learning cues and credibility judgements. *Med Educ* 2012;**46** (2):192–200.
8 Swanwick T. Informal learning in postgraduate medical education: from cognitivism to 'culturism'. *Med Educ* 2005;**39**:859–65.
9 Teunissen PW, Stapel DA, Scheele F, Scherpbier AJJA, Boor K, van Diemen-Steenvoorde JAAM, van der Vleuten CPM. The influence of context on residents' evaluations: effects of priming on clinical judgement and affect. *Adv Health Sci Educ Theory Pract* 2009;**14**:23–41.
10 van der Zwet J, Zwietering PJ, Teunissen PW, van der Vleuten CPM, Scherpbier AJJA. Workplace learning from a socio-cultural perspective: creating developmental space during the general practice clerkship. *Adv Health Sci Educ Theory Pract* 2011;**16**:359–73.
11 Sheehan D, Wilkinson TJ, Billett S. Interns' participation and learning in clinical environments in a New Zealand hospital. *Acad Med* 2005;**80** (3):302–8.
12 Sfard A. On two metaphors for learning and the dangers of choosing just one. *Educ Res* 1998;**27** (2): 4–13.
13 Lave J, Wenger E. *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press 1991;29.
14 Shulman LS. Signature pedagogies in the professions. *Daedalus* 2005;**134** (3):52–9.
15 Don G, Garvey C, Sadeghpour M. Theory and practice: signature pedagogies in music theory and performance. In: Gurung RAR, Chick NL, Haynie A, eds. *Exploring Signature Pedagogies: Approaches to Teaching Disciplinary Habits of Mind*. Sterling, VA: Stylus Publishing 2009;81–98.
16 Charmaz K. *Constructing Grounded Theory. A Practical Guide through Qualitative Analysis*. Thousand Oaks, CA: Sage Publications 2006;123–50.
17 Corbin J, Strauss A.*Basics of Qualitative Research*, 3rd edn. Thousand Oaks, CA: Sage Publications 2008; 73–8.
18 Watling CJ, Lingard L. Grounded theory in medical education research: AMEE Guide No. 70. *Med Teach* 2012;**34** (10):850–61.
19 Morse JM. The significance of saturation.*Qual Health Res* 1995;**5**:147–9.
20 Golde CM. Signature pedagogies in doctoral education: are they adaptable for the preparation of education researchers? *Educ Res* 2007;**36**:344–51.
21 Shulman LS. Pedagogies of uncertainty. *Liberal Educ* 2005;**91** (2):18–25.
22 Coughlin CN, McElroy LT, Patrick SC. See one, do one, teach one: dissecting the use of medical education's signature pedagogy in the law school curriculum. *Ga State Univ Law Rev* 2009-10;**26** (**2**):361–415.
23 Schrand T, Eliason J. Feedback practices and signature pedagogies: what can the liberal arts learn from the design critique? *Teach Higher Educ* 2012;**17** (1):51–62.
24 Davis DA, Mazmanian PE, Fordis M, Van Harrison R, Thorpe KE, Perrier L. Accuracy of physician self-assessment compared with observed measures of competence: a systematic review. *JAMA* 2006;**296**:1094–102.
25 Eva KW, Regehr G. Self-assessment in the health professions: a reformulation and research agenda. *Acad Med* 2005;**80** (Suppl 10):46–54.
26 Hu Y, Peyre SE, Arriaga AF, Osteen RT, Corso KA, Weiser TG, Swanson RS, Ashley SW, Raut CP, Zinner MJ, Gawande AA, Greenberg CC. Post-game analysis: using video-based coaching for continuous professional development. *J Am Coll Surg* 2012;**214** (1):115–24.
27 Gawande A. Personal Best: top athletes and singers have coaches. Should you? *The New Yorker*, 3 October 2011.
28 Manturzewska M. A biographical study of the life-span development of professional musicians. *Psychol Music* 1990;**18**:112–39.
29 Watling CJ, Lingard L. Toward meaningful evaluation of medical trainees: the importance of participants' perceptions of the process. *Adv Health Sci Educ Theory Pract* 2012;**17** (2):183–94.
30 Ajjawi R. Going beyond 'received and understood' as a way of conceptualising feedback. *Med Educ* 2012;**46** (10):1018–9.

Received 25 September 2012; editorial comments to authors 10 December 2012, 1 March 2013; accepted for publication 12 March 2013