

## A review of teaching skills development programmes for medical students

Gregory E Marton, Brendan McCullough & Christopher J Ramnanan

**CONTEXT** The CanMEDS role of Scholar requires that medical trainees develop their skills as medical educators. The development of teaching skills in undergraduate medical students is therefore desirable, especially in view of the teaching obligations in residency programmes.

**OBJECTIVES** The goal of this review was to identify the characteristics and outcomes of programmes designed to develop the teaching skills of undergraduate medical students.

**METHODS** The authors searched medical literature databases using combinations of the search terms 'medical student', 'teacher', 'teaching skills', 'peer teaching', 'near-peer teaching' and 'student as teacher'. Twenty papers fit the predetermined search criteria, which included original characterisations of specific programmes involving undergraduate medical students.

**RESULTS** Three types of initiative were identified in the reviewed articles: peer teaching programmes; teaching workshops, and community outreach programmes. The majority of study participants were students in Years 3 and 4. Subjective self-evaluation by participants using Likert scale-based surveys was by far the most commonly used method of measuring project outcomes. Objective, quantitative teaching-related outcomes were rarely noted in the reports reviewed. Self-perceived improvements in teaching skills were noted by participants in most of the reports. Other perceived benefits included increases in organisational skills, knowledge and confidence in giving feedback.

**CONCLUSIONS** Although several types of programmes have been shown to subjectively improve the teaching skills of undergraduate medical students, characterisation of the objective outcomes of these initiatives is lacking and requires further study.

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Department of Innovation in Medical Education, Faculty of Medicine, University of Ottawa, Ottawa, Ontario, Canada

*Correspondence:* Christopher J Ramnanan, Department of Innovation in Medical Education, Faculty of Medicine, University of Ottawa, 451 Smyth Road, Ottawa, Ontario K1H8MS, Canada.  
Tel: 00 1 135 625 800 (ext. 8702);  
E-mail: [cramnana@uottawa.ca](mailto:cramnana@uottawa.ca)

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 INTRODUCTION

All physicians are called upon to teach over the course of their careers, to varying degrees. Whether they play active roles in the education of colleagues, residents, medical students, allied health professionals or their patients, all doctors should be competent educators. The General Medical Council (GMC) states that medical graduates should 'function effectively as a mentor and a teacher'.<sup>1</sup> Moreover, the Accreditation Council for Graduate Medical Education (ACGME) and the Liaison Committee on Medical Education (LCME) strongly advocate for a resident role in teaching.<sup>2,3</sup>

Approximately one-third of medical student knowledge is attributed to resident teaching.<sup>4</sup> Because of this significant contribution to medical education, the concept of the resident-as-teacher (RaT) has been thoroughly explored in the literature.<sup>5</sup> In conjunction, many postgraduate medical programmes now offer varying degrees of training in teaching skills. However, because residents are expected to fulfil teaching responsibilities as early as in their first year of residency, teaching skills development should begin in medical school.<sup>6</sup> Dandavino *et al.* suggest three reasons for teaching medical students how to teach,<sup>6</sup> including: (i) medical students have future teaching roles as residents and faculty members; (ii) medical students who develop effective communication skills may have improved interaction with patients, and (iii) medical students with a better understanding of teaching strategies may become better learners themselves.

A recent survey of US medical schools showed that only 44% of respondents had formal student-as-teacher (SaT) programmes.<sup>7</sup> Additionally, in 2013, only 40% of UK medical schools had compulsory teaching skills development courses within the curricula.<sup>8</sup>

Despite the importance of developing teaching acumen in medical trainees, a widely accepted consensus of what a teaching skills programme for undergraduate medical students should entail does not currently exist, nor has there been any formal, broad characterisation of measurable outcomes from these initiatives. To address these deficits, and to help develop recommendations for the future development of such programmes, we reviewed the literature to identify medical student teaching skills development initiatives, and to describe and discuss the relevant teaching-related outcomes of these programmes.

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 METHODS

In July 2013, the authors searched three databases (Education Resource Information Center [ERIC], SCOPUS and PubMed) for articles meeting a set of predetermined criteria.

The inclusion criteria demanded that: (i) all study participants were medical students; (ii) participants acquired teaching experience or teaching skills, and (iii) the primary goals of the study included an investigation of the impacts of the study intervention(s) on participants' teaching skills or abilities.

The exclusion criteria prevented the review of: (i) any study not published in English; (ii) any study published before the year 1990, and (iii) any study with results that were superseded by those of a more recent publication.

The characteristics of the literature search are summarised in Fig. 1. Using various combinations of the search terms 'medical student', 'teacher', 'teaching skills', 'peer teaching', 'near-peer teaching' and 'student as teacher', 390 potentially relevant articles were retrieved. The titles and abstracts of these studies were read and 75 articles were deemed relevant to the project goals. These articles were read in full and their references were examined for any additional relevant sources. Twenty articles fulfilled the predetermined criteria.

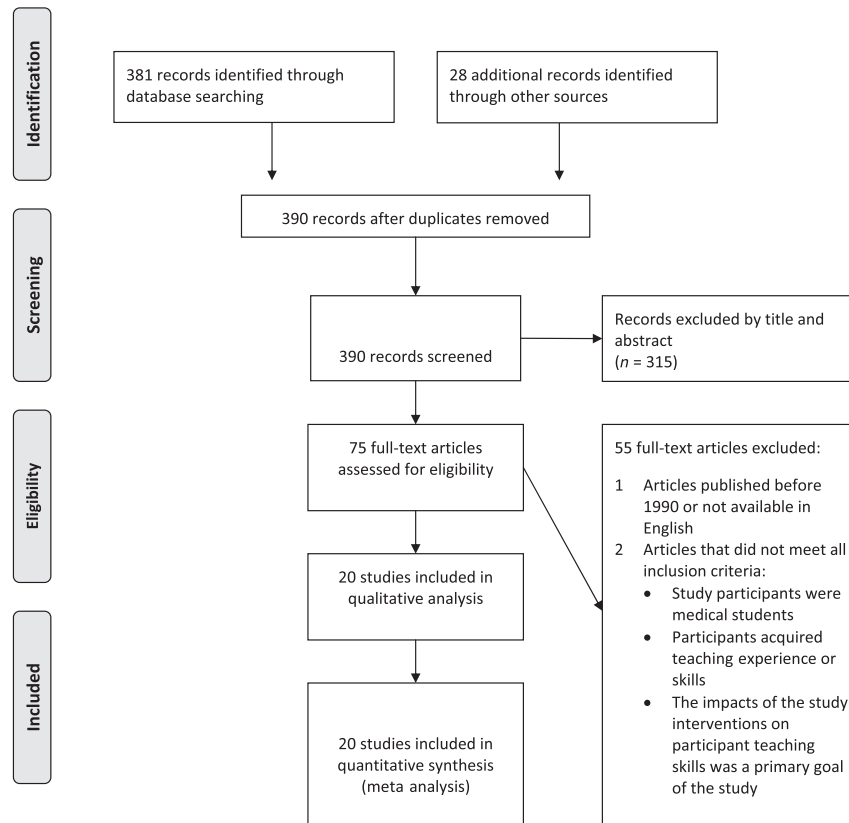
Studies describing faculty staff or resident teaching skills development programmes were beyond the scope of this review. Studies concerning teaching in other health care professions were also omitted.

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 RESULTS

The reviewed studies were published between the years 2002 and 2013 and represent research from institutions in five different countries. Nine articles were from the USA,<sup>9-17</sup> seven from the UK,<sup>18-24</sup> two from Australia<sup>25,26</sup> and one from each of Germany,<sup>27</sup> and Switzerland.<sup>28</sup>

Analysis of the reviewed literature revealed three common modalities of teaching skills programmes available to undergraduate medical students: (i) peer teaching; (ii) teaching workshops, and (iii) outreach programmes. These three modalities will be discussed as major themes in medical SaT training. Finally, student assessment and programme



**Figure 1** The literature search was conducted according to PRISMA (*preferred reporting items for systematic reviews and meta-analyses*) criteria

evaluation mechanisms that currently exist as part of these programmes will be discussed as these are elements critical to facilitating student progression and programme improvement.

### Peer teaching

Peer teaching was the subject of 11 of the 20 selected articles. Their characteristics are summarised in Table 1. Currently, the nomenclature for peer teaching programmes is not consistent and more than a dozen different terms are frequently used in the literature.<sup>29</sup> For the purpose of this review, cross-level teaching is defined as teaching in which the teacher and learner are at different educational levels (i.e. residents teaching medical students).<sup>30</sup> Near-peer teaching (NPT) is defined as teaching in which student teachers and student learners are at the same educational level but are separated by one or more years of training (i.e. senior medical students teaching junior medical students).<sup>30</sup> Reciprocal peer teaching (RPT) is defined as peer teaching in which student teachers and student learners are in the same year of training and the roles of teacher and learner are regularly

rotated among participants.<sup>11,30,31</sup> One reviewed article described an RPT programme<sup>11</sup> and ten articles described NPT programmes.<sup>10,13–15,17–19,21,26,27</sup>

Three dimensions were identified by ten Cate and Durning with which to characterise peer teaching in higher education: the distance in academic level between teacher and learner; the learner group size, and the formality of the teaching interaction.<sup>29</sup> For the purpose of this review, formal programmes are defined as those that are incorporated into the medical curriculum. Extracurricular or student-led programmes are informal. Additionally, Yu *et al.* discussed a fourth dimension: the frequency and duration of peer teaching interactions.<sup>30</sup>

The medical student teachers in the NPT programmes included students in Years 2–6 and eight of the ten programmes used at least some Year 3 or 4 students.<sup>10,13–15,17,19,21,27</sup> The NPT student learners included students in Years 1–3; learners in eight of the programmes were students in Year 1.<sup>10,13–15,19,21,26,27</sup> The most common distance in academic level was 2 years. Group sizes numbered between four and 24 students, but were not specified

Table 1 Summary of peer and near-peer teaching programmes in medical schools

Study	Country of origin	Type of teaching programme	Student teachers level (n)	Student learners level (n)
Moseley et al. (2002) <sup>13</sup>	USA	NPT	M4 (6)	M1, M2, M3 (NS)
Naeger et al. (2013) <sup>14</sup>	USA	NPT	M4 (18)	M1 (120)
Shiozawa et al. (2010) <sup>27</sup>	Germany	NPT	M2, M3 (10 trained and 10 untrained)	M1, M2 (197)
Erie et al. (2013) <sup>10</sup>	USA	NPT	M3 (25 over 5 years)	M1 (NS)
Evans & Cuffe (2009) <sup>19</sup>	UK	NPT	M4 (12)	M1, M2 (NS)
Buckley & Zamora (2007) <sup>18</sup>	UK	NPT	M5 (94)	M3 (271)
Ocel et al. (2003) <sup>15</sup>	USA	NPT	M3 (57 over 17 years)	M1 (NS)
Nelson et al. (2013) <sup>26</sup>	Australia	NPT	M6 (24)	M1, M2 (358 survey responders – 81%)
Nestel & Kidd (2005) <sup>21</sup>	UK	NPT	M3 (21)	M1 (NS)
Tang et al. (2004) <sup>17</sup>	USA	NPT	M4 (12)	M2 (NS)
Krych et al. (2005) <sup>11</sup>	USA	RPT	M1 (44)	M1 (44)

CBL = case-base learning; M1–6 = year of medical school; NA = not applicable; NPT = near-peer teaching; NS = not stated; RPT = reciprocal peer teaching; SP = standardised patient.

\* Likert-type survey.

† The article did not specify whether the results of learner surveys were forwarded to their peer teachers.

‡ Informal survey.

§ Open-ended survey.

¶ Self-rating of the degree to which learning objectives were met.

in all studies. All but one<sup>18</sup> of the reviewed NPT studies described formal peer teaching interactions. The duration of the peer teaching programmes varied significantly, from one 90-minute session<sup>14</sup> to 40 hours per week for 6 weeks.<sup>26</sup>

The reviewed RPT study used Year 1 students as both teachers and learners.<sup>11</sup> A total of 44 students participated in the study and all students had the opportunity to teach their peers at least once.<sup>11</sup> The student learner group size was 10 and, by definition, there was no difference in academic level among participants. The teaching interaction was formal.

The topic most commonly taught by student teachers was anatomy.<sup>10,11,14,15,19,27</sup> Other topics included clinical skills,<sup>13,18,26</sup> patient-centred interviewing,<sup>21</sup> and socio-cultural medicine.<sup>17</sup> There was some form of teacher training for student teachers in seven of 11 studies.<sup>10,14,17–19,21,27</sup> The peer teacher training in many studies included a thorough

review of the future teaching material by faculty educators.<sup>11,15,18–20,22</sup> The training in some studies also included a review of teaching strategies or small-group facilitation skills.<sup>10,17,19,21,27</sup> The exact content (i.e. specific objectives) of the peer teacher training was not thoroughly described in most studies. All peer teaching studies used teacher surveys to evaluate the outcomes of their interventions. Six studies also used learner surveys.<sup>11,14,19,21,26,27</sup> The vast majority of both were Likert-type surveys.

The results of these surveys noted that peer teaching improved the teaching or presentation skills of participants in nine of the reviewed studies.<sup>10,11,14,15,17–19,26,27</sup> The participants in two studies felt that they were now prepared to teach in residency.<sup>13,27</sup> Many studies noted that students felt they had improved their own understanding of the material.<sup>11,17,19,26</sup> Two studies noted that participants felt more confident in giving feedback.<sup>10,27</sup> Participants also noted improvements in many other

Dimensions of peer teaching interaction<sup>30</sup>

Academic level difference	Student group size	Formality	Programme frequency and duration	Programme evaluation	Material covered
1–3 years	NS	Formal	40 hours/week × 4 weeks	Teacher survey*	Clinical skills
3 years	5–6	Formal	1 × 1.5-hour session	Teacher survey* Learner survey* <sup>†</sup>	Ultrasound and anatomy
1–2 years	9–10	Formal	'Entire course'	Teacher survey* Learner survey* <sup>†</sup>	Anatomy dissection
2 years	NS	Formal	30 hours/week × 7 weeks	Teacher survey*	Anatomy
2–3 years	NS	Formal	Minimum 5–6 sessions	Teacher survey* Learner survey <sup>†,‡</sup>	Anatomy
2 years	NS	Informal	6 weeks	Teacher survey*	Clinical skills
2 years	NS	Formal	20–30 hours/week for 1 trimester	Teacher survey*	Anatomy
5–6 years	Large group: 24 Small group: 4	Formal	40 hours/week × 6 weeks	Teacher survey* Learner survey* <sup>†</sup> Teacher focus group	Clinical skills and CBL
2 years	6 students per 2 tutors	Formal	Two sessions	Teacher survey <sup>§,¶</sup> Learner survey <sup>†,‡</sup> SP survey <sup>†,‡</sup> SP interview	Patient-centred interviewing
2 years	10–12	Formal	1 × 1.5-hour session	Teacher survey*	Socio-cultural medicine
NA	10	Formal	33 sessions	Teacher/learner survey*	Anatomy

categories, including communication skills,<sup>11,18,19,26</sup> organisational skills,<sup>18,26</sup> confidence speaking in groups<sup>18</sup> and increased likelihood they would teach in the future,<sup>15,17,18</sup> among others.

In addition to teacher surveys and learner surveys, one study also surveyed the standardised patients involved in a peer-taught interview skills session.<sup>21</sup> This same study also examined the interview skills of student teachers before and after their participation in the programme.<sup>21</sup> There was no statistical difference. In another study, surveys of students taught in the anatomy laboratory by peer teachers who had received some form of teacher training were compared with those of students taught by peer teachers who had not received any training.<sup>27</sup> There was a statistically significant improvement in trained tutors' ability to convey dissection techniques, maintain an appropriate group atmosphere, and provide support of learning and structure visualisation in comparison with untrained tutors.<sup>27</sup>

When asked, student learners felt that their peer teachers were sufficiently knowledgeable.<sup>19,26,27</sup> Additionally, when addressed, there was no noted statistical difference in the examination results of students in peer-led groups in comparison with those in faculty-led groups.

### Teaching workshops

Seven of 20 reviewed articles described medical student teaching workshops. Their characteristics are summarised in Table 2. In all studies, the programme participants were students in Years 3 or 4 or 'senior' medical students. The programme durations were variable, ranging from a single 3-hour session<sup>20</sup> to a series of workshops over 60 hours.<sup>12</sup> Only one of the reviewed teaching workshops was a mandatory part of the curriculum.<sup>9</sup> The rest of the programmes were available to students as optional electives. Only one study described an informal, student-led teaching workshop.<sup>28</sup>

Table 2 Summary of literature on teaching workshops for medical students

Study	Country of origin	Student academic level (n)	Programme duration	Type of programme (formality)
Pasquale & Cukor (2007) <sup>16</sup>	USA	M4 (27)	1 week	Elective course (formal)
Haber et al. (2006) <sup>9</sup>	USA	M4 (NS)	4 × 1-hour sessions	Required course curriculum (formal)
Burgess et al. (2012) <sup>25</sup>	Australia	'Senior medical students' (17)	6 × 3-hour sessions	Elective course (formal)
Newton & Wright (2011) <sup>22</sup>	UK	M4 (NS)	1 day	NS
Merglen et al. (2008) <sup>29</sup>	Switzerland	M4 (16)	5 × 2-hour sessions	Elective course (informal)
Morrison et al. (2003) <sup>12</sup>	USA	M3 (35), M4 (15)	60 hours	Elective course (formal)
Nestel & Kidd (2002) <sup>20</sup>	UK	M3 (28)	3 hours	Elective course for peer tutors (formal)

M1–6 = year of medical school; NS = not stated; OSTE = objective structured teaching encounter; RPT = reciprocal peer teaching.

\* Likert-type survey.

† Verbal feedback.

‡ Written feedback.

All of the reviewed workshop studies used student surveys to evaluate the outcomes of their intervention. The majority of these were Likert-type surveys. One study also held an additional student focus group as part of its programme evaluation.<sup>25</sup>

The feedback from these surveys was generally positive. The participants in four studies noted that the workshops improved their teaching or facilitation skills.<sup>16,20,22,25</sup> The medical students in three studies felt better prepared to teach in residency.<sup>9,12,16</sup> Two studies noted increased confidence in giving feedback<sup>20,25</sup> and the participants in one of those studies also noted that the programme motivated them to improve clinical teaching standards in the future.<sup>25</sup>

### Outreach programmes

Two of the 20 articles reviewed concerned medical student outreach programmes. Their characteristics

are summarised in Table 3. Both studies described outreach programmes in which medical students travelled to community schools to teach health-related topics to secondary school students.<sup>23,24</sup>

In the first study, conducted over the course of 6 days, Year 3 medical students organised and presented two lessons on science, health and higher education.<sup>24</sup> Students were given written feedback by high school teachers on their teaching performance.<sup>24</sup> The participating medical students evaluated the programme using online surveys. The programme was valued among participants for 'the development of teaching skills and practice'.<sup>24</sup>

In the second outreach programme, Year 1 medical students taught four 50-minute workshops on mental health.<sup>23</sup> The students were given feedback by high school teachers and the programme supervisor on their teaching performance.<sup>23</sup> The study used

Programme description	Programme evaluation	Teaching opportunity	Feedback on teaching opportunity
One-week course 'with three primary goals in mind: to increase students' knowledge concerning educational theory; to begin to develop individualised approaches to teaching; and to better understand how individuals learn'	Student survey*	1 M2 M3 clinical skills teaching 2 Peer 'microteaching' session	M2, M3 students <sup>†</sup> Peers <sup>†</sup> Resident instructors <sup>†</sup> Faculty instructors <sup>†</sup>
'The first two sessions of the teaching course address: (i) teaching methods which promote understanding and retention in the clinical setting, and (ii) evaluating students fairly and providing constructive feedback. In the third session a panel of residents addresses student questions and concerns regarding the challenges of teaching as an intern. The fourth session is dedicated to practising and discussing teaching skills in small groups led by residents recognised as outstanding teachers of medical students'	Student survey*	No	No
'The <i>Teaching on the Run</i> programme contains six modules providing theoretical background, practical examples and active participation in a range of activities, including skills teaching, assessment and how to provide effective feedback in the clinical context'	Student survey* Student focus group	No	No
'One-day clinical teaching course designed to improve students' teaching skills and equip them with a basic understanding of how to lead a teaching session in a clinical context'	Qualitative student survey	RPT of a clinical skill	Peers <sup>‡,†</sup>
'Interactive workshops addressing the following six themes: one-to-one peer teaching; training in procedural skills; giving feedback; orienting peers in a new clinical environment; interprofessional communication, and reflective practice based on logbook recordings'	Student survey*	Standardised peer teaching formative assessment	Results of formative assessment
'Series of didactic and practice sessions to develop students' skills as teacher and evaluators.' Students also 'learned to enact and rate eight teaching stations in an OSTE that tests generalist resident's teaching skills'	Student survey*	1 Peer teaching session 2 Staffing resident OSTE	NS
Three-hour workshop 'included brainstorming, discussion, reflection, role-play, videotape replay, lecture attendance and use of a manual'	Student survey*	'Simulated sessions'	NS

informal medical student feedback and learner surveys to evaluate the outcomes of the outreach programme.<sup>23</sup> Learner feedback was extremely positive as '101/109 pupils said that they would recommend the workshop to a friend'.<sup>23</sup> Medical student educators noted that the programme improved their teamwork and teaching skills.<sup>23</sup>

### Feedback and evaluation

Participating medical students did not receive feedback on their teaching performance in most reviewed studies. Only three of 11 peer teaching studies specifically noted that teaching performance feedback was given to participants by faculty members<sup>10,17</sup> or student learners.<sup>10,21</sup> Five of the seven teaching workshops offered a practice teaching opportunity for participants.<sup>12,16,20,22,28</sup> Only three of these workshop studies specifically noted that direct feedback on performance was given by super-

vising faculty staff.<sup>16,22,28</sup> The medical students in both outreach programmes received feedback from participating high school teachers.<sup>23,24</sup>

The most common means of programme evaluation was, by far, Likert scale-based surveys of participating medical students. Subjective self-evaluation by participants was the only measured outcome in most of the reviewed studies. In fact, objective and quantitative teaching-related outcomes were measured in only two studies. As mentioned previously, in the first study, the patient-interviewing skills of peer teachers were evaluated in a mock interview with a standardised patient and compared with previous mock interview scores of both project participants and non-participants.<sup>21</sup> There was no significant difference in interview scores before and after peer teaching or between participants and non-participants.<sup>21</sup> In the second study, students taught in the gross anatomy laboratory by peer teachers who had received some

Table 3 Summary of literature on medical student outreach programmes

Study	Country of origin	Medical student level (n)	Audience level (n)	Programme duration (formality)	Programme description	Topics	Programme evaluation	Feedback on teaching performance
Furmedge (2008) <sup>24</sup>	UK	M3 (100)	Secondary school (NS)	6 days (formal)	'Students spent a total of 6 full days in school placements, in science or health care-based lessons, where they were encouraged to move from classroom observer, to teaching assistant, to teacher over the weeks. The course emphasised the planning and delivery of a minimum of two lessons, and the delivery of information about higher education, focusing on medicine, in the form of a talk or lesson'	Science, health and higher education	Medical student survey	School teachers <sup>†</sup>
Jones et al. (2011) <sup>23</sup>	UK	M1 (4)	Secondary school (109)	4 × 50-minute (formal)	The workshop was divided into three parts: an initial didactic presentation using images and videos; a role play addressing mental health stigma in schools, and small-group work to explore further what had been discussed	Mental health	Learner survey* Informal medical student feedback	School teachers Programme supervisor

M1–6 = year of medical school; NS = not stated.

\* Likert-type survey.

† Written feedback.

form of teacher training were compared with those taught by peers who had not received any training.<sup>27</sup> As previously described, the analysis of learner survey data indicated statistically significant differences between trained and untrained peer teachers in several aspects of teaching in the anatomy laboratory.<sup>27</sup>

## DISCUSSION

There is universal acknowledgement among medical associations and governing bodies across the world that teaching skills are a valuable asset to physicians. In the UK, the GMC states that medical graduates should be able to perform effectively as mentors and teachers.<sup>1</sup> Additionally, in Canada, the CanMEDS roles dictate that medical trainees should develop their skills as medical educators.<sup>32</sup> In response, many residency programmes now offer varying degrees of teacher training. However, because residents are

expected to take on teaching responsibilities as early as in their first year of residency, some medical schools have also begun to integrate formal teaching programmes designed to develop the teaching ability of their medical students. A review of the literature revealed three types of initiative for developing the teaching skills of medical students: peer teaching programmes; teaching workshops, and outreach programmes. All initiatives improved the self-perceived teaching skills of participants, among other benefits. There was, however, a notable lack of teaching performance feedback for participants in many studies. Additionally, only two studies reported measurable objective outcomes.

### Peer teaching

Peer teaching is extremely common in medical education. A 2008 survey of US medical schools found that all responding schools utilised their students as



teachers or tutors in some fashion.<sup>7</sup> Moreover, 87.9% of responding medical schools used medical students as peer tutors specifically for students requiring extra academic help.<sup>7</sup> Only 44.0% of respondents, however, offered their students formal SaT programmes.<sup>7</sup>

Although a large amount of information on peer teaching in health care education has been published, only a few studies have examined the effects or benefits of peer teaching on the teachers themselves. The majority of publications specifically address the learning outcomes of students taught by peer teachers; these articles were previously reviewed by Secomb<sup>33</sup> in 2008 and Yu *et al.*<sup>30</sup> in 2011. Many of these publications appear to indicate that medical students taught by peer teachers maintain similar grades to those taught by faculty staff in a number of different subjects.<sup>17,26,34–45</sup> Some of these reports also indicate that student learners perceive that peer teachers create a stronger group learning atmosphere,<sup>31</sup> deliver more effective feedback,<sup>31</sup> and are more accessible than their faculty counterparts.<sup>44</sup> The advantage of peer teachers over faculty educators appears to refer to the cognitive and social congruence they share with their students.<sup>29</sup> Peer teachers are better able to understand and address the knowledge gaps and cognitive struggles of their students because their own level of understanding of the material is more comparable – or congruent.<sup>29</sup> The idea of social congruence indicates that students may be more comfortable asking a question of a peer, who holds no inherent position of authority over them.<sup>29</sup> This might help ‘facilitate disclosure of ignorance and cognitive errors’ that can then be addressed.<sup>29</sup> However, reports addressing the student learning outcomes of peer teaching in medical education have not all been completely positive. Some studies have reported concerns over the adequacy of the knowledge of peer tutors<sup>44</sup> and the reliability of their teaching.<sup>34</sup> Additionally, one report noted that some students preferred being taught by faculty teachers.<sup>46</sup>

The studies addressed in this review indicate that peer tutors benefit from their teaching experience. Peer teaching improves student teachers’ self-perceived teaching skills,<sup>10,11,14,15,17–19,26,27</sup> knowledge,<sup>11,17,19,26</sup> communication<sup>11,18,19,26</sup> and confidence,<sup>18</sup> among other aspects. Additionally, as mentioned, student learners also appear to benefit from the additional teaching support offered by peer tutors. Medical schools should therefore consider peer tutors as a viable educational resource:

both student learners and student teachers benefit from peer teaching. With respect to improving the teaching skills of medical students, peer teaching programmes ranging in duration from a single session<sup>14,17</sup> to multi-week initiatives<sup>10,26</sup> have been shown to be viable. Programmes that covered the teaching of students in Years 1 or 2 by students in Years 3 or 4 were most commonly reviewed. These types of initiative allow senior students to improve their teaching skills just prior to residency while also offering support to junior students as they adapt to the challenging medical curriculum.

### Teaching workshops

A 1992 survey of medical students indicated that 90% of respondents would partake in a teaching skills workshop prior to residency, if one was available.<sup>4</sup> This same survey also noted that only 14% of respondents had any formal teaching instruction.<sup>4</sup> The studies addressed in this review indicate that medical student teaching workshops improve the self-perceived teaching skills,<sup>17,21,23,26</sup> feedback skills<sup>21,26</sup> and readiness for residency<sup>10,13,17</sup> of participants. It is worth noting that although teaching workshops appear to be effective in improving the teaching skills of medical students, there are no secondary gains to this type of initiative. In peer tutoring or outreach programmes, students improve their teaching skills while also educating peers or community members. This does not occur with teaching workshops. Teaching workshops do have another advantage, however. Teaching skills workshops do not appear to require a significant amount of time to be effective. The reviewed workshops ranged from 3 to 60 hours in duration, but most were of <10 hours. All workshops were highly rated and valued by participants.

### Outreach programmes

Medical students represent an excellent resource for the development of community health education programmes. They are economical, willing, available and medically knowledgeable. Medical students have been shown to be effective in teaching elementary and high school students natural science,<sup>24,47</sup> health science<sup>24</sup> and mental health,<sup>23</sup> among other subjects. In this way, medical students can begin contributing to the overall health of their communities long before they graduate. The reviewed outreach programmes were also able to improve the self-perceived teaching skills of participating medical students.<sup>23,24</sup>

## Feedback and evaluation

Most of the reviewed studies did not offer feedback on teaching performance. Student or observer feedback is a key component to improving as a teacher. When done properly, the feedback process allows teachers constructive insight into what they do well and what they struggle with. Additionally, positive feedback can serve as a powerful motivator to continue teaching.<sup>40</sup> Any programme designed to improve the teaching skills of medical students should include a feedback component. Feedback from experienced faculty staff can be especially valuable.

By far the most common means of evaluating a programme and of assessing student teaching skills in the studies reviewed was the application of a Likert scale-based survey of participating medical students. In fact, subjective self-assessment surveys by medical student participants in these teaching programmes represented the only outcome measurements in the majority of reviewed studies. Unfortunately, these subjective outcomes do not necessarily correlate with objective changes. This lack of objectivity limits the strength of the conclusions of all reviewed studies.

One way in which objective changes in teaching skills might be assessed is through the use of an objective structured teaching encounter (OSTE). An OSTE can evaluate the teaching performance of participants in an objective way. In an OSTE, participants teach standardised patients a predetermined lesson while their teaching skills are evaluated by an independent observer.<sup>48</sup> A recent review by Trowbridge *et al.* noted that the OSTE was a reliable and probably valid means of assessing teaching skill.<sup>48</sup> Additionally, there is some evidence that participating in an OSTE itself actually improves the teaching skills of participants.<sup>48</sup> Objective structured teaching encounters are currently used only at the level of residents and faculty staff. Their use at the medical school level has not been addressed in the literature. Like objective structured clinical examinations, they are also costly and time-consuming to organise.

Another method of objectively assessing changes in teaching skill is through learner surveys. In one reviewed study, the student learner surveys of students taught by peer teachers who had received some form of training in teaching were compared with those of students taught by peer teachers who had not received any training.<sup>27</sup> There was a statisti-

cally significant difference in the evaluations of trained student teachers in comparison with their untrained counterparts. This lends support to the idea that feedback from student learners is valuable to student teachers. Additionally, there is evidence that learner evaluations correlate with OSTE scores among obstetrics and gynaecology residents.<sup>49</sup> Integrating formal assessments by learners into SaT programmes may therefore be a time- and cost-effective mechanism (unlike OSTE) of providing valid formative feedback to medical students on their teaching abilities. The assessment of medical student teachers by learner surveys may be limited by problems frequently associated with surveys, such as poor response rates, non-representative responses, and a lack of specificity of comments.

A third method available for the objective assessment of teaching performance and skill is evaluation by experienced faculty staff. On the whole, as mentioned previously, faculty feedback or evaluation was uncommon in the reviewed studies. Only two of the reviewed peer teaching studies noted that participating students were given direct feedback by faculty staff.<sup>10,17</sup> Both outreach programmes also noted that high school teachers assessed participants' teaching skills.<sup>23,24</sup> One programme specifically noted that this evaluation of teaching performance contributed to the students' overall grades.<sup>24</sup> The exact detail of these assessments was not thoroughly discussed in any study. Further characterisation of the best means of offering constructive feedback and evaluation of medical student teaching performance is needed. Evaluation by experienced faculty staff is currently used as a method of assessing teaching skill among resident teachers.<sup>49</sup> Assessment of medical student teachers by faculty staff may be limited by the difficulty of recruiting faculty members who are able to dedicate the time to observe, assess and communicate feedback to each teaching programme participant.

## Limitations

Although the drive to develop physicians who are competent educators is universal, we limited our review to studies published in English. As a result, medical student teaching initiatives in non-English-speaking countries were not included in this study. The study was also limited by the fact that many of the medical schools that offer some form of teaching skills development initiative have no published articles describing their programmes. For example, a 2008 national survey of medical schools in the

USA indicated that 44% of these schools had formal SaT programmes,<sup>7</sup> but only a small fraction of these schools have formally characterised their programmes in the literature. In addition to the relative lack of objective data characterising SaT educational skills, the studies in the reviewed literature were limited by the absence of the longitudinal characterisation of teaching activity and teaching ability in participants. Our review was therefore unable to address the question of whether SaT programmes in medical school lead to long-term changes in teaching performance.

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## CONCLUSIONS

Three types of medical student teaching skills development initiative were identified: peer teaching programmes; teaching workshops, and outreach programmes. All initiatives improved the self-perceived teaching skills of participants. Many other benefits were also noted, including increased confidence, better organisation skills, better communication skills and better preparedness for residency, among other factors. Nonetheless, there appears to be room to optimise both the assessment of teaching skills in programme participants (to incorporate meaningful feedback from students and faculty members) and programme evaluation mechanisms (to include objective measures).

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