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Research

Academic half days, noon conferences and classroom-based education in postgraduate medical education: a scoping review

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Abstract

Background: Classroom-based education (CBE) is ubiquitous in postgraduate medical education (PGME), but to date no studies have synthesized the literature on the topic. We conducted a scoping review focusing on academic half days and noon conferences.

Methods: We searched 4 databases (MEDLINE [OVID], Embase [OVID], ERIC [EBSCO] and Web of Science) from inception to December 2021, performed reference and citation harvesting, and applied predetermined inclusion and exclusion criteria to our screening. We used 2 frameworks for the analysis: "experiences, trajectories and reifications" and "description, justification and clarification."

Results: We included 90 studies, of which 55 focused on resident experiences, 29 on trajectories and 6 on reification. We classified 44 studies as "description," 38 as "justification" and 8 as "clarification." In the description studies, 12 compared academic half days with noon conferences, 23 described specific teaching topics, and 9 focused on resources needed for CBE. Justification studies examined the effects of CBE on outcomes, such as examination scores (17) and use of teaching strategies in team-based learning, principles of adult learning and e-learning (15). Of the 8 clarification studies, topics included the role of CBE in PGME, stakeholder perspectives and transfer of knowledge between classroom and workplace.

Interpretation: Much of the existing literature is either a description of various aspects of CBE or justification of particular teaching strategies. Few studies exist on how and why CBE works; future studies should aim to clarify how CBE facilitates resident learning within the sociocultural framework of PGME.

Workplace learning centred on authentic participation in patient care is the foundation of postgraduate medical education (PGME).[1,2] Many residency programs supplement learning through regular, scheduled classroom-based education (CBE) by scheduling academic half days or noon conferences. Although workplace learning and CBE complement one another, they often compete for time and attention.[3] Residents report an overabundance of "service" training and favour formal learning ("education") such as lectures over work experience.[4] These tensions between service and education in PGME are explored in detail by the experiences, trajectories and reifications (ETR) framework.[5] This framework is used for examining practice-based learning in health care settings, wherein a range of situations lead to experiences; individuals' experiences join to form their different developmental trajectories. The intersection of, and interaction between, individual trajectories in the workplace leads to reification of practice and learning.[5] Reification refers to processes and products (objects or artifacts) by which we enact practices.[6] One example of this is how residents dictate their discharge summaries, which is both a process and product of their practice. Practice creates, and is created by, recurring activities that are the result of, and shape, our experiences.

Classroom-based education helps to shape the interpretation and reification of clinical experiences.[7] For example, residents on call may have a string of experiences, including seeing their first case of lobar pneumonia and presenting at a noon conference. Noon conferences afford opportunities for reflection and knowledge acquisition, and how to learn the more subtle aspects of microbiology and pharmacology. Together, experiences facilitate a trajectory toward being competent as a physician. Repetition of discrete experiences, presented later in the classroom, reifies the importance of overnight call as an educational activity (and not just "service") and the complementary role of CBE in acquiring deeper knowledge. Although

Competing interests: None declared.

This article has been peer reviewed.

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***CMAJ Open* 2023 May 9. DOI:10.9778/cmajo.20210203**

workplace learning theory has been well studied in PGME,[8–10] less is perhaps known about CBE and its role. For example, there seems to be no compelling argument for or against CBE in residency, and lectures and other classroom activities are still widely used. Given the uncertainties and gaps in this domain, our research questions for this scoping review were as follows: 1) What is the scope of the literature on classroom-based learning in PGME? 2) What do residents and faculty see as the value of classroom-based learning in PGME? 3) What are the gaps in the literature and priorities for future studies in CBE?

Our literature search focused on retrieval of studies on academic half days and noon conferences, which are common forms of CBE in Canada and the United States.[3,11] Postgraduate medicine learning is highly social and participatory, and not focused solely on individual acquisition of knowledge or skills.[12] Thus, we examined individual cognitive aspects as well as sociocultural aspects.

Methods

Study design

In our scoping review, we were guided by Arksey and O'Malley's framework for scoping reviews and, for our reporting, by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) scoping review extension.[13–18] We used 5 steps for our review: formulating the research objectives; identifying relevant studies; selecting the studies; charting the data; and collating, summarizing and reporting the results.

Literature search

We iteratively developed searches in consultation with a medical librarian (D.G.) and a peer reviewer who used the Peer Review of Electronic Search Strategies (PRESS) checklist.[19] We searched 4 bibliographic databases that index medical education research: MEDLINE and Embase on Ovid, Education Resources Information Center (ERIC) on EBSCO, and the Web of Science Core Collection, from inception to January 2022. We restricted searches to English but imposed no date limits. Search terms included relevant controlled terms and the free-text search phrases: "academic half day*"; morning conference*, noon conference*; flipped classroom*; resident lecture*, etc., and postgraduate medical education (Appendix 1, available at www.cmajopen.ca/content/11/3/E411/suppl/DC1). To increase search sensitivity of highly relevant papers, we performed reference harvesting of key included articles and citation searching in Google Scholar.

Our inclusion criteria were that studies from any publication be primary research examining CBE in PGME. We included qualitative and quantitative studies. We excluded studies if they were not primary research (e.g., editorials) or were not focused on CBE or postgraduate medical learners. Two authors (T.Q. and L.C.) iteratively developed a screening process based on the inclusion criteria to determine the final set of included studies for review. Our review focuses on traditional face-to-face CBE. However, the related topics of simulation, e-learning (or blended learning) and flipped classrooms were not included for 2 reasons: because they are not central in face-to-face teaching and learning, and because high-quality reviews already exist on those topics (e.g., simulation;[20] e-learning or blended learning;[21,22] and flipped classrooms[23–25]).

Data analysis

We used 2 frameworks to analyze the included studies. First, we tabulated the articles according to the ETR framework and whether they focused on resident experiences, trajectories or reifications. Within these tables, we also determined where each study best fit in the "description, justification and clarification" framework.[26] This second framework addresses the purposes of medical education research. Description studies ask: "What was done?" Justification studies ask: "Did [the intervention] work?" Clarification studies ask: "Why or how did it work?" This framework can be used in parallel with ETR, and to our knowledge, this is the first article to use both. Two authors (L.C. [a clinician educator] and T.Q. [experienced in physical sciences and qualitative educational research]) categorized the included studies; disagreement was resolved by discussion and consensus.

Ethics approval

We did not require ethics approval as all data were available in published records.

Results

We screened 521 full-text studies and identified 90 that met our inclusion criteria (Figure 1). Most included articles were from Canada and the US, 3 from Europe[27–29] and 1 from Thailand.[30] Three studies reported on collaborations between North American or European and African training programs.[31–33] Studies from numerous specialties, such as anesthesia, surgery, pediatrics, internal medicine, family medicine and psychiatry, were included. The results of the review are structured to show whether the purpose of the study can be classified as description, justification or clarification, followed by the main level(s) of analysis in the study according to the ETR framework; and finally, the principal research topics or questions addressed.

Tables 1, 2 and 3 provide an overview of included studies, grouped and labelled according to the ETR framework. Of these studies, 55 were primarily about resident experiences, 29 about learning trajectories and 6 about reifications. We classified 54 studies as description articles,[27,31–83] 28 as justification articles[11,28,30,84–108] and 8 as clarification articles.[3,7,29,109–113] Figure 2 shows the number of included studies published from 1996 to 2022.

Description studies

The level of analysis in nearly all these studies was on trainees' experiences. Description studies (Table 1) focused on CBE format, such as transitioning from noon conferences to academic half days; some focused on specific content or topics for CBE, and others on the resources required to create and maintain CBE.

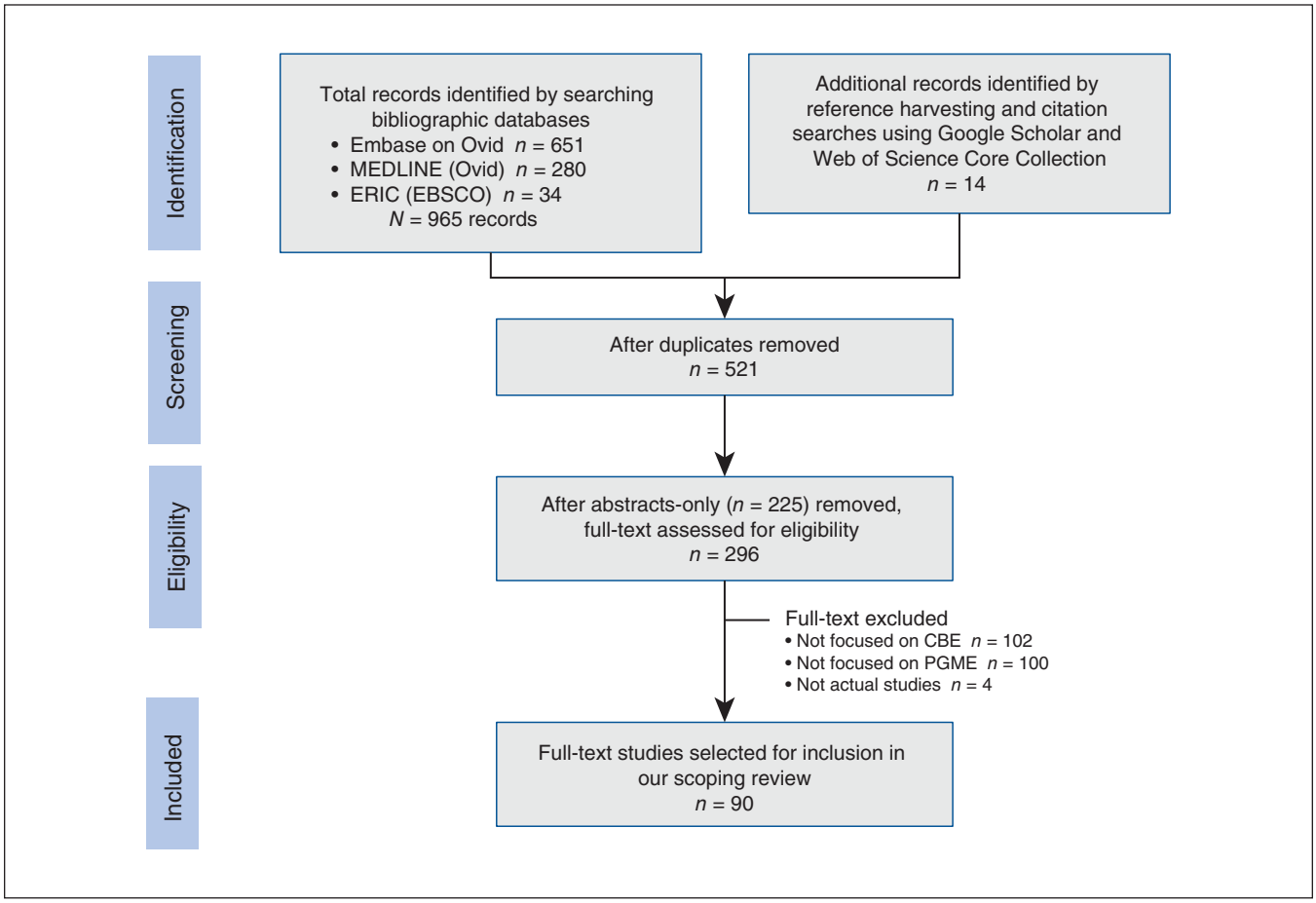

Figure 1: PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram of study identification and selection process. Note: CBE = classroom-based education, ERIC = Education Resources Information Center, PGME = postgraduate medical education.

Format of CBE

A recurring topic is the merits of blocked versus dispersed formats. Dispersed formats are regular, short (e.g., 30–90 min) sessions such as noon conferences, which occur multiple times a week. Blocked formats such as academic half days are longer and less frequent (e.g., weekly 3- to 5-hour sessions).[46] Dispersed formats entail minimal interruption of acute clinical services, as residents are typically onsite at academic hospitals. By contrast, blocked formats require attending physicians or others to cover clinical duties for residents who have 3 or more hours of "protected time." Blocked formats emerged from American rural family medicine programs in the 1990s as an alternative to dispersed formats, with the purpose of improving attendance and facilitating novel educational methods such as simulation.[108,114] Academic half days are relatively common in North America; for example, 20 of 21 Canadian neurology programs had academic half days in 2003,[46] and 55.6% of American family medicine programs had them once a year in 2016.[45,52] Other broad categories of CBE may include other trainees (e.g., medical students) and faculty with presentations or case discussions. Many programs have a "morning report," in which a case from the previous call shift or recent admission is discussed.[51,75] Morbidity and mortality rounds are an opportunity to discuss adverse events with the intention of improving quality and reducing medical errors.[27,44] Many programs include journal clubs to teach evidence-based medicine and to enhance medical literature critical appraisal skills.[72]

Classroom-based education content and topics

The literature describes specific topics delivered in classrooms, ranging from traditional topics such as insulin pump use[39] and psychopharmacologic interventions,[54] to competencies such as communication skills and transition to practice.[32,67,71] Accreditation Council for Graduate Medical Education and CanMEDS standards are cited often as the impetus for nonmedical expert topics such as global health and surgical safety.[67,81]

Resources required for CBE

Classroom-based education requires faculty, administrative and infrastructure resources. One academic psychiatry training program implemented "flipped" biannual academic half days for faculty development, wherein residents cover clinical services and faculty members are able to attend faculty development.[42] Near-peer and peer-to-peer are effective and

Table 1 (part 1 of 4): Studies focusing on "experiences"

Author, year	Journal	Country	Location	Discipline(s)	Participants	Design	Study topic	Description, justification or clarification
Acosta et al., 2014[34]	*Postgraduate Medical Journal*	USA	University of Florida	Internal medicine	67 residents	Pre- and post-intervention questionnaire	Clinical approach to obesity	Description
Al Achkar et al., 2018[35]	*BMC Medical Education*	USA	Washington and Indiana	Numerous	233 of 1757 program directors	Survey study	Interprofessional education in PGME	Description
Albert et al., 2021[36]	*Journal of General Internal Medicine*	USA	10 centres in USA	Internal medicine	497 residents	Survey study	Resident perceptions of morning report	Description
Anderson et al., 2021[37]	*Journal of Surgical Education*	USA	University of California, Davis	Surgery	129 US surgical programs	Survey study	Surgeon perceptions of morbidity and mortality rounds	Description
Audcent et al., 2013[38]	*Pediatrics*	Canada	Ottawa	Pediatrics	125 trainees	Mixed methods	Global child health modules	Description
Bansal et al., 2018[39]	*Postgraduate Medical Journal*	USA	State University of New York	Pediatrics	34 residents	Survey study	Resident module on insulin pumps	Description
Barnwell et al., 2017[40]	*Journal of Surgical Education*	USA	Wake Forest University	Orthopedics	Survey of 24 residents	Survey study	Case-based v. traditional lectures	Description
Barrett et al., 2021[41]	*MedEdPortal*	USA	Emory University	Dermatology	Not specified	Descriptive study	Educational module on diversity and sexuality	Description
Bowman et al., 2015[43]	*Clinical Teacher*	USA	University of Minnesota	Internal medicine	57 residents	Survey study	Teaching high-value care in morning report	Description
Brown et al., 2018[44]	*International Urology and Nephrology*	Canada	University of Ottawa	Nephrology	Not specified	Descriptive study	Morbidity and mortality rounds in renal disease	Description
Butler et al., 2017[45]	*Family Medicine*	USA	USA (numerous)	Family medicine	291 of 441 programs surveyed	Survey study	Survey of family medicine didactic teaching	Description
Chalk et al., 2004[46]	*Canadian Journal of Neurological Sciences*	Canada	McGill University	Neurology	21 program directors	Survey study	Overview of AHD in Canadian neurology programs	Description
Clay et al., 2016[47]	*Critical Ultrasound Journal*	USA	Oregon Health & Science University, Portland	Internal medicine	33 residents	Pre- and post-intervention test scores	Ultrasound skills in critical care	Description
Cosimini et al., 2016[48]	*Medical Education*	USA	University of Southern California	Pediatrics	36 conferences and 1043 resident arrivals	Retrospective study	Effect of food on attendance at NCs	Description
Denizard-Thompson et al., 2018[49]	*MedEdPortal*	USA	Wake Forest	Internal medicine and family medicine	25 internal medicine, 36 family medicine residents	Survey study	Musculoskeletal module for residents	Description

Table 1 (part 2 of 4): Studies focusing on "experiences"

Author, year	Journal	Country	Location	Discipline(s)	Participants	Design	Study topic	Description, justification or clarification
Di Genova et al., 2015[50]	*Paediatric and Child Health*	Canada	McGill	Pediatrics	14 pediatrics residents	Survey study	AHD redesign, focus on CanMEDS roles	Description
Dreyer et al., 2014[31]	*World Journal of Surgery*	Scotland and Zambia	Dumfries and Zambia	General surgery	13 faculty, 24 residents	Mixed methods	Surgical emergencies course for African programs	Description
Durning et al., 2003[51]	*Teaching and Learning in Medicine*	USA	Uniformed Services University	Internal medicine	Numerous	Mixed methods	Comparing morning report content to curricular guidelines	Description
Fraser et al., 2016[89]	*Journal of Graduate Medical Education*	USA	Harvard Medical School	Internal medicine	153 residents	Survey study	NC effectiveness and impact on self-study	Justification
Hill et al., 2000[52]	*Family Medicine*	USA	US residency programs	Family medicine	278 programs	Survey study	Study of conference format in family medicine	Description
Juo et al., 2019[53]	*Journal of Surgical Education*	USA	University of California, Los Angeles	General surgery	8 faculty, 32 trainees	Survey study	Medical malpractice	Description
Kavanagh et al., 2017[54]	*Academic Psychiatry*	USA	Columbia	Psychiatry	144 residents	Survey study	Psychopharm-acology-prescribing workshops	Description
Klein et al., 2008[55]	*Canadian Family Physician*	Canada	University of Alberta	Family medicine	Not specified	Mixed methods	Academic conferences and impact on self-study	Description
Ksouri et al., 2010[27]	*American Journal of Critical Care*	France	Université Paris-Descartes	Critical care	260 deaths	Mixed methods, descriptive study	Educational impact of morbidity and mortality rounds	Description
Logan et al., 2021[56]	*MedEdPortal*	USA	University of California, San Francisco	Internal medicine	35 residents	Survey study	Virtual case series module for clinical reasoning	Description
Marchalot et al., 2017[28]	*Anaesthesia Critical Care and Pain Medicine*	France	University of Rouen	Anesthesia	308 residents	Pre–post study	Traditional v. flipped classrooms in anesthesia	Justification
Mickelson et al., 2009[57]	*Canadian Urology Association Journal*	Canada	University of British Columbia	Urology	Not specified	Descriptive study	Implementation of adult learning principles	Description
Mishra et al., 2013[97]	*Urology*	USA	Cleveland Clinic	Urology	8 fellows, 24 residents	Survey study	Surveys on a new electronic case	Justification
Naumberg et al., 1997[59]	*Academic Medicine*	USA	University of Rochester, NY	Family medicine	Program directors	Survey study	Early description of AHDs	Description
Pembroke et al., 2018[62]	*Practical Radiation Oncology*	Canada	McGill University	Radiation oncology	6 residents	Mixed methods	Quality improvement	Description

Table 1 (part 3 of 4): Studies focusing on "experiences"

Author, year	Journal	Country	Location	Discipline(s)	Participants	Design	Study topic	Description, justification or clarification
Pentiuk et al., 2012[63]	*J Pediatric Gastroenterology & Nutrition*	USA	Cincinnati Children's Medical Centre	Pediatrics	31 residents	Survey study	Gastroenterology fellows as teachers program	Description
Pereira et al., 2008[64]	*Palliative Medicine*	Canada	University of Calgary	Rural family medicine	36 residents	Survey study	Palliative care	Description
Randall et al., 2020[100]	*American J Medical Sciences*	USA	University of Florida	Internal medicine	95 residents	Survey study	Resident well-being	Justification
Richardson et al., 2018[65]	*Teaching and Learning in Medicine*	USA	Vanderbilt	Cardiology	22 cardiology fellows	Survey study	Guidelines adherence sessions	Description
Ritchie et al., 2018[111]	*Medical Science Educator*	USA	University of Colorado	Pediatrics	12 faculty	Focus group study	Faculty perspectives of AHD	Clarification
Robbins et al., 2018[66]	*Surgery*	USA	University of Wisconsin	Vascular surgery	4 trainees and 4 faculty	Survey study	Transition from NC to AHD	Description
Salib et al., 2015[67]	*Southern Medical Journal*	USA	University of Texas at Austin	Internal medicine	Not specified	Survey study	Communication skills workshop	Description
Salib et al., 2018[68]	*Southern Medical Journal*	USA	University of Texas at Austin	Internal medicine	50 residents	Survey study	Business of medicine	Description
Sawatsky et al., 2014[112]	*Journal of Graduate Medical Education*	USA	University of Pittsburgh	Internal medicine	41 residents	Focus group study	Learning preferences in NC	Clarification
Sawatsky et al., 2015[69]	*Medical Education Online*	USA	University of Pittsburgh	Internal medicine	20 faculty	Focus group study	Challenges to active learning in conferences	Description
Schynoll et al., 2018[70]	*Journal of Graduate Medical Education*	USA	Albany Medical College	Internal medicine	64 faculty, 89 residents	Survey of faculty and residents	Team-based learning	Description
Shaffer et al., 2017[71]	*Clinical Teacher*	USA	Stanford University	Numerous	78 residents	Survey study	Practice transition modules	Description
Shifflette et al., 2012[72]	*Journal of Surgical Education*	USA	Methodist Dallas Medical Center	General surgery	26 program directors	Survey study	Journal clubs in surgery programs	Description
Smith et al., 2016[73]	*Journal of Graduate Medical Education*	USA	University of Wisconsin	Respirology, hematology/ oncology, cardiology	46 fellows	Randomized crossover study	Effect of paging reminders on attendance at conference	Description
Solbach-Sabbach et al., 2019[74]	*Education for Health*	Israel	Technion: Israel Inst. of Technology	Family medicine	56 residents	Mixed methods	Resident research skills	Description
Stiles et al., 2006[75]	*Current Surgery*	USA	University of Virginia	General surgery	25 residents	Survey study	Morning report	Description
Stokes et al., 2017[33]	*Canadian Medical Education Journal*	Canada and Guyana	University of Calgary; University of Guyana	Internal medicine	191 (Guyana) and 16 (Calgary) residents	Survey study	Calgary and Guyana videoconference sessions	Description
Tam et al., 2017[76]	*MedEdPortal*	Canada	Hospital for Sick Children	Pediatrics	28 residents	Survey study	Pediatric limb pain module	Description

Table 1 (part 4 of 4): Studies focusing on "experiences"

Author, year	Journal	Country	Location	Discipline(s)	Participants	Design	Study topic	Description, justification or clarification
Tanaka et al., 2016[77]	*Anesthesiology Research and Practice*	USA	Stanford University	Anesthesiology	131 residents	Survey study	Short daily lectures in anesthesia	Description
Tarabichi et al., 2018[78]	*Journal of Surgical Education*	USA	Rutgers University	General surgery	Not specified	Pre- and post-test results	Knowledge from assigned reading and lectures	Description
Theophanous, et al., 2021[79]	*Medical Education*	USA	Chicago	Pediatrics and other specialties	Not specified	Descriptive study	Residents as teachers	Description
Thomas et al., 2005[80]	*Teaching and Learning in Medicine*	USA	Mayo Clinic	Internal medicine	20 residents	Pre- and post-test results	Conference attendance and test scores	Description
Wong et al., 2009[81]	*BMC Medical Education*	Canada	University of British Columbia	Internal medicine	64 residents	Survey study	Communication skills workshop	Description
Zanotti et al., 2019[82]	*Journal of Graduate Medical Education*	USA	University of Chicago	Gynecology	Gynecology fellows	Mixed methods	Value-based care	Description
Zeller et al., 2015[92]	*Southern Medical Journal*	Canada	McMaster University	Internal medicine	31 residents	Mixed-methods study	Anatomy module for learning bone marrow biopsies	Description

Note: AHD = academic half day, NC = noon conference, PGME = postgraduate medical education.

decrease faculty teaching load.[63,79] One pediatric residency program reported that providing lunch with noon conferences was associated with statistically significant improvements in attendance and punctuality.[48]

Justification studies

We identified justification studies as surveys and quasi-experimental before-or-after intervention studies that examined the effectiveness of CBE as well as used different teaching strategies (Table 2). The outcomes examined in these studies included in-training examination scores and resident satisfaction. No studies examined patient care outcomes. Most studies focused their analysis on the learning trajectories of residents.

Effectiveness of CBE

Residents reported that they were more likely to attend lectures and pursue self-directed learning when topics were clinically relevant, well presented and focused on clinical reasoning.[89] Two studies found a positive association between noon conference attendance and in-training examination scores,[93,94] but 4 did not.[85,87,90,96] A transition from noon conferences to academic half days was associated with improvements in resident attendance, satisfaction and in-training examination scores.[11,86,100] One prospective cohort study comparing dispersed versus massed delivery of a nutrition course for gastroenterology fellows showed better long-term knowledge in the dispersed cohort.[99]

Teaching strategies

Many studies focusing on teaching strategies were motivated by poor resident attendance, difficulty in planning CBE, and lack of perceived resident and faculty engagement in classroom learning. These studies aimed to revive or refresh attendance and impact of their classroom-based learning by applying principles of andragogy and active learning.[50,57,104] Team-based learning improved resident engagement and satisfaction in a pediatrics program.[105] The wide availability of Web-based resources has facilitated use of the flipped classroom model in several programs.[28,102,103] Videos have been used in CBE to enhance teaching of topics such as bone marrow biopsy and communication skills.[81,83]

Clarification studies

A few studies were aimed at clarifying issues in CBE (Table 3). These included studies examining the role of CBE in resident education, the perspectives of faculty and residents on CBE, and the issue of learning transfer between classroom and workplace. We found all 3 levels of the ETR framework in the clarification papers, and many focused on the reification of learning in the classroom setting.

The role of CBE in resident education

One of the few multicentre studies examined the transition from noon conferences to academic half days in 3 internal medicine programs.[109] This study retrospectively identified 6 core principles for implementation of CBE: protect time

Table 2 (part 1 of 3): Studies focusing on "trajectories"

Author, year	Journal	Country	Location	Discipline(s)	Participants	Design	Study topic	Description, justification or clarification
Armson et al., 2021[84]	*Family Medicine*	USA	University of Calgary	Family medicine	139 residents	Focus group study	Resident perceptions of small-group learning in AHD	Justification
Batalden et al., 2013[109]	*Academic Medicine*	USA	Harvard, Cincinnati, Cornell NY	Internal medicine	Not specified	Qualitative	Transition from NC to AHD	Clarification
Cacamese et al., 2004[85]	*Medical Teacher*	USA	Johns Hopkins University	Internal medicine	13 residents	Pre- and post-test results	Effect of conference attendance on test scores	Justification
Eid et al., 2015[86]	*BMC Medical Education*	USA	MD Anderson Cancer Center	Hemotology and oncology	Survey, interviews	Mixed methods	Effectiveness of transition from NC to AHD	Justification
Fitzgerald et al., 2003[87]	*Academic Medicine*	USA	University of California, Los Angeles	Internal medicine	81 residents	Cross-sectional	Examine association between resident attendance and examination scores	Justification
Franklin et al., 2017[88]	*Journal of Pediatric Orthopaedics*	USA	Pittsburgh and Hamot	Orthopedics	196 residents	Pre- and post-intervention test scores	Effect of pediatric teaching module on in-training examination scores	Justification
Gene Hern et al., 2009[90]	*Academic Emergency Medicine*	USA	4 US emergency medicine programs	Emergency medicine	405 residents	Attendance and test results	Conference attendance and test scores	Justification
Goyal et al., 2019[91]	*Diagnosis (Berlin)*	USA	Johns Hopkins University	Internal medicine	Not specified	Pilot study, descriptive	Description of a focused morning-report format for interns	Justification
Ha et al., 2014[11]	*Journal of Graduate Medical Education*	USA	Cleveland Clinic	Internal medicine	364 residents	Pre- and post-test results	Transition from NC to AHD: results of in-training examination scores and surveys of learning satisfaction before and after	Justification
House et al., 2017[92]	*AEM Education & Training*	USA	Children's Hospital of Pennsylvania	Pediatrics	122 residents	Randomized crossover study	Spaced education as an adjunct to traditional education effect on test scores	Justification
Limvorapitak et al., 2016[30]	*J Medical Assoc Thailand*	Thailand	Thammasat University	Internal medicine	19 residents	Cross-sectional	Test scores in internal medicine	Justification

Table 2 (part 2 of 3): Studies focusing on "trajectories"

Author, year	Journal	Country	Location	Discipline(s)	Participants	Design	Study topic	Description, justification or clarification
Lin et al., 2018[32]	*Journal of Surgical Education*	USA and Rwanda	Colorado, Harvard, Kigali	Surgery, anesthesia, obstetrics	55 residents	Survey study	Surgical safety program run by American surgery programs for a residency program in Kigali, Rwanda	Description
McDonald et al., 2007[93]	*Journal of General Internal Medicine*	USA	Mayo Clinic	Internal medicine	195 residents	Cross-sectional	Test scores in internal medicine	Justification
McDonald et al., 2008[94]	*Mayo Clinic Proceedings*	USA	Mayo Clinic	Internal medicine	195 residents	Cross-sectional	Examine association of conference attendance with internal medicine in-training examination scores	Justification
Mehta et al., 2018[95]	*Journal of Surgical Education*	USA	University of Utah	Plastic surgery	8 residents	Pre- and post-intervention test scores	90-min weekly didactic sessions and their impact on test scores	Justification
Meyer et al., 2018[96]	*Academic Radiology*	USA	Michigan Medicine	Radiology	54 residents	Cross-sectional	Conference attendance and test scores	Justification
Moreno et al., 2013[58]	*Journal of Graduate Medical Education*	USA	University Wisconsin–Madison	Pediatrics	70 residents	Pre- and post-survey	Eliminated NC and implemented a new block format	Description
Ozuah et al., 2001[60]	*Archives of Pediatrics & Adolescent Medicine*	USA	Albert Einstein College	Pediatrics	80 residents	Cohort study	No impact of problem-based learning impact on self-directed learning	Description
Parikh et al., 2008[61]	*American Journal of Surgery*	USA	University of California, Los Angeles	General surgery	60 residents	Survey study	Description of new structures lectures	Description
Picciano et al., 2003[98]	*Family Medicine*	USA	JFK Medical Center	Family medicine	20 residents	Cohort study	Effectiveness of NCs for increasing residents' knowledge for both short term (1 mo) and long term (7 mo)	Justification
Raman et al., 2010[99]	*Medical Teacher*	Canada	University of Calgary and University of Toronto	Gastroenterology fellows	10 (Calgary) + 10 (Toronto) gastroenter-ology fellows	Prospective cohort study	Comparison of AHD v. dispersed in a nutrition course	Justification

Table 2 (part 3 of 3): Studies focusing on "trajectories"

Author, year	Journal	Country	Location	Discipline(s)	Participants	Design	Study topic	Description, justification or clarification
Riddell et al., 2017[101]	*Journal of Graduate Medical Education*	USA	University of California, San Francisco–Fresno, San Fran General, University of Southern California	Emergency medicine	73 residents	Randomized crossover study	Traditional v. flipped classroom in emergency medicine	Justification
Rose et al., 2016[102]	*Journal of Emergency Medicine*	USA	University of Southern California	Emergency medicine	17 residents	Pre- and post-intervention test scores	Traditional v. flipped classroom	Justification
Rucker et al., 2017[103]	*Advances in Medical Education and Practice*	USA	Indiana and Washington	Family medicine	Not specified	Descriptive study	Evidence-based medicine and technological literacy	Justification
Sawatsky et al., 2014[104]	*BMC Medical Education*	USA	University of Pittsburgh	Internal medicine	69 residents; 4 faculty	Survey study	Surveys and test scores after implementation of active learning	Justification
Volerman et al., 2019[105]	*BMC Medical Education*	USA	University of Chicago	Pediatrics	47 students and residents	Survey study	Team-based learning	Justification
Winter et al., 2007[106]	*Family Medicine*	USA	JFK Medical Center and Rutgers Univ.	Family medicine	17 residents	Pre- and post-test score results	NC attendance and test scores	Justification
Zastoupil et al., 2017[107]	*Academic Pediatrics*	USA	University of Colorado	Pediatrics	Not specified	Mixed methods	Transition from NC to AHDs	Justification
Zweifler et al., 1996[108]	*Academic Medicine*	USA	San Francisco, Colorado, U. Washington	Family medicine	Not specified	Descriptive study	First description of AHDs	Justification

Note: AHD = academic half day, NC = noon conference.

and space to facilitate learning, nurture active learning in residents, choose and sequence curricular content deliberately, develop faculty, encourage resident preparation and accountability for learning and employ a continuous improvement approach to curriculum development and evaluation. In identifying these principles, the investigators reified what they intended CBE in their institutions to be.

A qualitative study from internal medicine, orthopedic surgery and hematology showed that residents believe knowledge acquisition is CBE's primary purpose.[3] Specifically, residents believe that learning in the classroom should complement that in the workplace and guide self-directed learning. Moreover, CBE is an important space for social support and forming communities of practice. For residents rotating through many different disciplines and training sites, CBE can provide an academic "home base," important to their individual professional identity formation.[7]

Faculty and resident perspectives on CBE

Two studies at the University of Colorado examined faculty perspectives of CBE. In one, faculty said they valued the opportunity to get to know residents in smaller classroom settings, but struggled with ascertaining the optimal content for academic half days and also expressed uncertainty about the long-term impact of their teaching.[111] The second study focused on the impact of academic half days on faculty, which included increased difficulty in dealing with ward- and systems-based care issues while residents were away.[115] These challenges were amplified by resident absences owing to duty hour restrictions and continuity clinics, highlighting the importance of considering the entire "curriculum" in residency when designing educational experiences. Another qualitative study of internal medicine and internal medicine–pediatrics residents explored learning preferences regarding noon conferences.[112] Residents wanted content that was clinically relevant,

Table 3: Studies focusing on "reifications"

Author, year	Journal	Country	Location	Discipline(s)	Participants	Design	Study topic	Description, justification or clarification
Bhatt-Mackin et al., 2017[42]	*Academic Psychiatry*	USA	Duke University	Psychiatry	Not specified	Descriptive study	Protecting time for faculty development	Description
Chen et al., 2017[7]	*Medical Teacher*	Canada	University of British Columbia	Family medicine	30 residents and faculty	Qualitative case study	Professional identity formation	Clarification
Chen et al., 2015[3]	*Academic Medicine*	Canada	University of British Columbia	Orthopedics, internal medicine and hematology	27 residents	Qualitative case study	Role of AHD in resident education	Clarification
Gregor et al., 2016[110]	*Teaching and Learning in Medicine*	Canada	University of Toronto and Queen's University	Not specific	Not specified	Critical literature synthesis	Purpose of morbidity and mortality rounds	Clarification
Peters et al., 2018[29]	*Teaching and Learning in Medicine*	Netherlands	University of Leuven	General practice	25 trainees, 11 faculty, 18 workplace supervisors	Transfer of learning	Transfer of learning during internship	Clarification
Wagoner et al., 2019[115]	*Teaching and Learning in Medicine*	USA	University of Colorado	Pediatrics	12 faculty	Survey study	Attending physician perspectives on AHD	Clarification

Note: AHD = academic half day.

practical and linked to evidence. They also wanted sessions that were structured around cases and questions, and that used active learning with resident engagement.

Transfer between classroom and workplace

Transfer of learning, defined as "the application and refinement of competencies in a context that is different from that in which the competencies were acquired," is a challenge.[116] Transfer can be affected by characteristics of the classroom (relevance of classroom activities to clinical practice), characteristics of the clinical workplace (attending-resident contact) or resident characteristics (e.g., motivation). One qualitative study examined transfer between the classroom and clinical workplace in first-year general-practice residents in Belgium.[29] The study produced 3 key findings: 1) There are 3 distinct phases to the transfer process: a) preparing for transfer of learning; b) being at the workplace and connecting back to classroom-based learning; c) reflecting on transfer of learning and continuing the process. 2) Clarifying who is responsible for transfer of learning is critical. At times, the trainees felt medical teachers and workplace supervisors needed to take more responsibility for transfer of learning, and vice versa. 3) Participants' conceptions about each phase of the transfer process reflected their opinions about who was responsible for enabling the transfer.

Gregor and Taylor have reviewed the literature on morbidity and mortality rounds, applying experiential learning theory to show how this type of CBE can contribute to individual development of clinical mastery as well as systems-based quality improvement.[110]

Interpretation

The studies included in our review show that classroom-based learning in PGME is hindered by a lack of an agreed-upon conceptual terminology to describe educational interventions. This lack presents a number of challenges in gathering and studying this literature. For future studies, we propose the use of a more inclusive, umbrella term such as "classroom-based education" to facilitate better alignment of practice and theory, and the labelling of studies.

Further classifying the literature using the ETR and description, justification and clarification frameworks sheds light on which areas may benefit from clarification studies. Almost all description studies focus on experiences offered to residents, such as the format or topic of CBE or residents' descriptions of their experiences. Several justification studies examined resident learning trajectories, albeit indirectly, through association between residents' attendance at CBE and

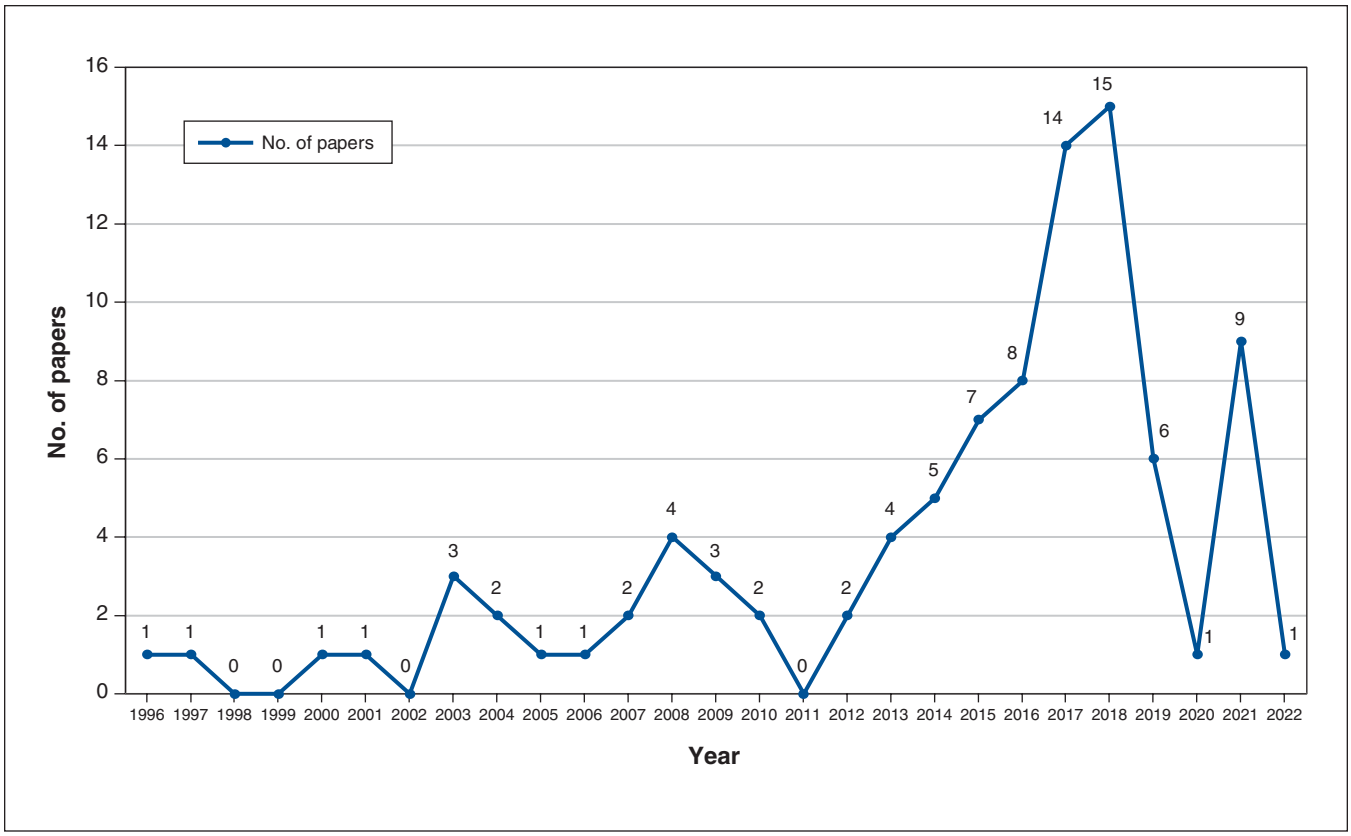

Figure 2: Number of included studies (n = 94) published from 1996 to 2022.

their in-training examination scores. Description studies generally examined CBE using an individual, cognitivist lens rather than sociocultural theories of learning.[4] Clarification studies focus their analysis at the experience, trajectory or reification level by examining how CBE in residency affects learning and practice and how both interact. For example, resident academic half days, when combined with other resident absences owing to duty hour restrictions and continuity clinics, have unintended system outcomes of emotional strain and patient safety concerns for attending physician faculty members.[115]

The examination of CBE shows the tensions between residents' clinical service and their ongoing education. Sociocultural theories such as cultural–historical activity theory, practice architectures and situated learning are highly relevant in understanding these tensions.[4] Residents participate in CBE primarily for knowledge acquisition but also for its social aspects, including peer support and forming communities of practice.[3] Peters and colleagues are in favour of placing learning in classrooms and workplaces as a contextual, socially mediated process rather than as individual cognitive processes.[29] An investigator examining the various topics "covered" in CBE through the lens of cultural–historical activity theory, which uses the educational system rather than the individual learner as the unit of analysis, might ask how the various components of PGME fit together, and what role CBE might play in relation to other components such as workplace learning and self-study.

Classroom-based education should aim to promote the goals of residency programs and residents' educational needs. Many residents and faculty view CBE as the primary way for training programs to promote their commitment to education.[7,117] Activities that occur in the workplace are determined primarily by the needs of patients and health care systems, and only secondarily by the teaching and learning concerns of faculty and residents. The classroom is where faculty can exercise more control over the format and content of teaching, which may be used to carry out accreditation requirements in addition to primary teaching concerns. Both within and beyond these 2 spaces of classroom and workplace, residents can exercise agency in determining their own learning trajectories. Importantly, medical education should complement and enhance rather than thwart the health care system in which it occurs.[1]

This review has provided a foundation for research into academic half days, noon conferences and CBE in PGME. As a potential future direction, focusing on threshold concepts known as "portals of entry into expertise" during classroom time may present opportunities for meeting faculty and resident goals.[118,119] Debriefing to facilitate transfer of learning between simulation and workplace has recently been described[120] and could potentially be applied to link the classroom and workplace. The impact of CBE on resident wellness and affective dimensions such as empathy could be explored in future studies.[121]

Limitations

The protocol for our review was not formally registered. We did not set alerts for the searches. The searches were English only. We included only indexed, peer-reviewed studies and did not search the grey literature for this topic, except for those papers we found during reference harvesting, which may have had a negative impact on our overall yield. We chose the ETR and description, justification and clarification framework to examine this body of research, although other theories, such as the sociocultural theories reviewed by Cleland and Durning,[4] would also be relevant to this body of literature.

Conclusion

This review provides an overview of classroom-based learning in PGME and recommends a common vocabulary and framework for future research. Classroom-based learning in PGME has been explored extensively from an individual, cognitivist perspective. Future studies using a sociocultural lens to examine CBE or examining the interplay of CBE with workplace learning may help to clarify the best use of time and resources.

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Contributors: All of the authors contributed to the conception and design of the work. Pim Teunissen, Luke Chen, Tien Quach and Riki Dayan contributed to the acquisition, analysis and interpretation of data. All of the authors drafted the manuscript, revised it critically for important intellectual content, gave final approval of the version to be published and agreed to be accountable for all aspects of the work.

Funding: Luke Chen's research is supported by salary support from the University of British Columbia Hematology Research Program for unrestricted educational research.

Data sharing: All data presented are available in the published record.

Supplemental information: For reviewer comments and the original submission of this manuscript, please see www.cmajopen.ca/content/11/3/E411/suppl/DC1.