Review

Medical Education for Healthcare Improvement

Peter Davey[*1], Evie Fioratou, Vicki Tully[1], Natalie Lafferty[1]

1. Medical School Lead for Healthcare Improvement, University of Dundee, UK

[*]Corresponding author: Peter Davey, Medical School Lead for Healthcare Improvement, University of Dundee, UK, E-mail: p.g.davey@dundee.ac.uk

Abstract

There is international recognition of the need to raise the quality, safety and value of healthcare services. However, teaching quality and safety to healthcare professional students uses pedagogies with a narrow focus on knowledge, skills and didactic learning that is not connected with the design and delivery of actual patient care. Three systematic reviews have investigated the characteristics of successful undergraduate or postgraduate programmes and their impact on outcomes of importance to patient care. Students and doctors in training learn more about improvement by working with clinical teams than from didactic classroom sessions. Students can be a valuable resource for improving healthcare but success requires support through being embedded in an inter-professional learning cohort with both academic and clinical mentoring. However, there are significant challenges in finding space for learning about improvement within crowded curricula and there is a lack of clarity about which improvement competencies are a priority for healthcare students. The Habits of Improvers provides a fresh approach that enables students and faculty to see improvement as a way of working rather than an isolated curriculum component or 'project'. Applying the Habits of Improvers requires pedagogies that enable co-learning, where teachers, students, clinicians, patients and families learn together how care can be improved. Learning should be iterative, moving from problem definition to prototype to testing and back to a more refined understanding of the problem. We recommend service-learning as a signature pedagogy for healthcare improvement through multiple learning opportunities that are integrated but visible in the curriculum.

Keywords: medical Education, undergraduate, quality improvement, patient safety, service-learning

Introduction

Healthcare improvement is defined as "Any systematic effort intended to raise the quality, safety and value of healthcare services, usually done at the system level" [1]. The authors of the revised SQUIRE Guidelines for Systematic Quality Improvement Reporting Excellence recommended the use of healthcare improvement rather than 'quality improvement', which often refers to more narrowly defined approaches [1]."

Over the past three decades the idea of improving healthcare has taken root across the world [2]. In 2015 the UK the Universities and Colleges Admissions Service had 37 accredited post-graduate courses (MSc, Diploma, Certificate) which purport to teach aspects of improving quality in healthcare [2]. However, there are major concerns about the current methods for teaching improve-ment to healthcare professionals:

"To the extent that quality and safety are addressed at all, they are taught using pedagogies with a narrow focus on content transmission, didactic sessions that are spatially and temporally distant from clinical work, and quality and safety projects segregated from the provision of actual patient care" [3].

In this review we summarise evidence about education for healthcare improvement, assess how the evidence has been applied at the University of Dundee and make recommendations for further development. The focus is on undergraduate medical education and transition into the first years of practice.

Background: What Do We Know About Medical Edu-

cation for Healthcare Improvement?

Three systematic reviews about quality improvement education in healthcare have been published since 2015 [4-6]. We summarise the evidence from these reviews and the recommendations from the Habits of an Improver, which is a thought paper from the Health Foundation [2]. The Habits of an Improver was intended to promote discussion and to be a possible model for taking decisions about the best balance of attitudes, skills and knowledge in education, training and continuing professional development for improvement in healthcare [2].

Evidence from systematic reviews

The evidence includes studies of undergraduate or postgraduate training in medicine, nursing, pharmacy or other professions (Table 1). The majority of studies are from the USA (Table 1).

One review used descriptive statistics to analyse evidence from 99 postgraduate training programmes [6]. Three a priori chosen curricular features were strongly associated with studies reporting outcomes of importance to patient care: an inter-professional learner cohort; a QI project embedded in the curriculum and coaching, defined as expertise provided to the teams in applying QI methods during the intervention (Table 2). We have used these curriculum characteristics as themes for reviewing the evidence from the other two reviews [4,5]. In addition we identified "curriculum balance and educational outcomes" as a fourth theme that was common to the non-quantitative reviews [4, 5], Evidence about postgraduate medical education is from 36 studies in Jones 2015 [5], of which two included medical students who collected data for an audit [7] or a survey [8] but were not involved in an intervention. Evidence about undergraduate medical education is from 12 studies [9-20]. One of these studies [12] was included in both reviews [4, 5].

Theme 1: Inter-professional learner cohorts
Postgraduate

Teaching about improvement within a clinical setting creates opportunities for Inter-professional engagement and education [5]. The core clinical team for improvement includes a wide range of roles and professions, for example appointment secretaries, accounting representatives, clinic administrators, nursing personnel, laboratory technicians, physicians, nurse practitioners, and resident physicians [21-23]. If programs are teaching systems-based practice then it makes sense to teach across specialties and professions [24].

In addition nursing and departmental support [23] and administrative engagement [24] were important for the success of improvement projects in terms of their impact on outcomes with patient or organisational benefit.

Undergraduate

None of the studies included students from more than one profession. However, an important impeding factor in undergraduate education was difficulty engaging with the range of staff in clinical teams, who appeared reluctant to allow students to implement significant changes [12, 18] and could perceive students' quality improvement activity as threatening, asking 'is there something wrong here?' [14]. These perceptions need to be challenged with evidence that students in the early years of their education can develop and use improvement skills [20] and that students represent an underutilized resource in efforts to improve the quality of care afforded the public [12].Students need to be seen as valued members of a clinical team and the clinical teams need to perceive themselves as an inter-professional learner cohort.

Theme 2: Coaching and Mentoring
Postgraduate

Commitment from administrative, academic, and clinic leadership is critical to fully engage faculty [25]. Some studies attributed the success of their programs to having faculty with QI knowledge and experience [26,27], which may be lacking in many settings. The time required for mentoring residents was variable, for example from three hours spread over four weeks once the curriculum for residents was in place to up to 10 hours per month for mentoring fellows through their work [26-28].

Undergraduate

Support from personal lecturers, practice educators or link tutors was important [9], with keen mentor support in practice seen as critical to the success of improvement projects [13,16], However, some students became frustrated with the difficulty in finding a mentor to guide their projects [16]. Lack of academic mentorship was an important barrier if faculty lacked quality improvement expertise and were unable to guide students [14].

Theme 3: QI project in the curriculum
Postgraduate

All 36 postgraduate studies reported outcomes about patient or organisational benefit (5). A QI project was included in the curriculum in 28 studies. Residents and fellows joined a clinical QI team (12 studies) or formed an improvement team (11 studies) or worked alone [5]. In the remaining eight studies the design was audit, feedback and re=audit (5). Three studies reported challenges with identifying educational and clinically relevant project topics [22,28,29].

Undergraduate

Of the six studies involving medical students three (50%) included an improvement project in a clinical setting: one in ambulatory care [12] and two in a mixture of inpatient and outpatient settings [19,30]. All three studies with QI projects in the curriculum reported outcomes of importance to patient care [12,19,20] and one study also provided examples of projects about

Table 1. Characteristics of three systematic reviews of quality improvement educational interventions in healthcare

Study	Study period	Context	Evidence Synthesis	Studies	Professions	Countries	Outcomes
[4]	2000-2016	Undergraduate only	Narrative	10	Nursing 5 Medicine 4 Pharmacy 1	USA 5 UK 3 Norway 2	Impact by Kirkpatrick Education Evaluation Model levels 1. Experience 2. Knowledge and attitudes 3. Behaviour 4. Organisation (4a) and patient benefit (4b) Enabling and Impeding factors
[5]	2000-2013	Postgraduate only 34[a] Undergraduate only 3 Undergraduate & postgraduate 2[a]	Realist	39	Medicine	USA 37 Canada 1 Israel 1	Characteristics of successful QI curricula
[6]	2007-2013	Postgraduate only	Meta-narrative(21)	99	Multiple	USA 84 Non-US 14 Both 1	Are three pre-specified curricular features associated with studies reporting outcomes of importance to patient care? 1. Inter-professional learner cohort 2. QI project 3. Coaching[b]

Notes

a. In the review one study is cited as involving medical students, residents and fellows (5) but the original paper says that the students were from a Masters level nursing programme (22). We have classified this study as postgraduate only.
b. Coaching was defined was defined as: "*expertise provided to teams in applying QI methods during the educational intervention, which may or may not include a required QI project*" (6).

Table 2. Summary of results from three systematic reviews of quality improvement educational interventions in healthcare

Study	Results
Armstrong 2017 (4)	Kirkpatrick Levels: • Level 1: Reaction of students was positive in all studies. • Level 2: Impact on attitudes was positive in all studies. Five studies reported improvement in QI knowledge (11, 12, 15, 17, 18) • Level 3: No studies included impact on behaviour. • Level 4: Only one study included impact on clinical processes and benefit to patients Enabling and impeding factors

Factor	Enabling	Impeding
Teaching Approaches	Experiential learning; access to free e-learning from IHI (Institute for Healthcare Improvement)	Lack of practical opportunities; inadequate preparatory learning
Clinical/Faculty Support	Mentor support in practice	Difficulty finding clinical mentors; clinical staff perceiving QI work as threatening; lack of QI expertise in academic staff
Information Provision	Structured assignments; examples of completed QI projects; group work	Poor understanding of the task to be undertaken impedes students' ability to inform staff about what they are doing
Curriculum Balance		Lack of dedicated time; instruction to work on QI projects when "more important tasks" were completed
Data availability		Lack of information about where to collect data; perception that data were tedious, non-educational or irrelevant

Study	Results
Jones 2015 (5)	Characteristics of successful QI clinical QI curricula: Interface of educational & clinical systems: • Medical students can, and should be expected, to contribute to quality of care in the clinical setting • Residents are front-line providers and have deep insights into the clinical processes and system. • The availability of clinical and systems data has a direct positive impact on learner satisfaction and engagement • Opportunities for inter-professional engagement and education can be found in teaching about QI within the clinical setting Choice of QI work • Identifying educational and clinically relevant project topics is challenging • Consider having trainees choose their own project. • Choose topics of clinical importance. Use near misses as a way to identify system errors Appropriately trained faculty: • Successful QI teaching in the clinical setting requires support from both educational and care delivery leaders. • Programs can be successful by either engaging all faculty around QI or by having dedicated QI faculty in the clinical setting Outcomes: • There is lack of clarity around whether educational and clinical outcomes are of equal or relative hierarchical importance • Sustainable projects can impact the culture of the clinical setting, but unsustainable projects may dishearten participants
Starr 2016 (6)	Association (Odds Ratio, 95% CI). between studies reporting clinical processes or patient benefit outcomes and three curriculum features: • Inter-Professional Learning 6.55 (2.71-15.52) • Coaching 4.38 (1.79-10.74) • QI project in curriculum 13.60 (2.92-63.29)

improving staff wellbeing [19]. Medical students in the remaining three studies produced a proposal for an improvement project [16,17] or collected data for an audit without any intervention [11]. None of these studies reported outcomes about patient or organisational benefit [11,16,17].

Theme 4: Curriculum balance and educational outcomes
Postgraduate

There was a lack of clarity around the relative importance of educational and clinical outcomes in postgraduate education [5]. It may be more pragmatic and effective to focus on clinical outcomes and allow educational outcomes to follow because *"the education of trainees (and others) may come more from doing QI than from studying it"* [31]. In addition there was evidence that the educational benefits extended beyond the improvement project (identifying unstable patients and escalating care) with evidence of more general decrease in house staff errors of judgment [32].

Sustainability of project outcomes was important for clinical teams and trainees and unsustainable projects may leave the trainee and other participants disheartened about improvement work [5]. One study reported that initiatives that decreased burden in clinic were more likely to be sustained. However, structural changes to the clinic, while positive for clinic workflow, often had unintended consequences that affected the sustainability of QI projects. [33].

Undergraduate

Balancing the quality improvement workload within the undergraduate curriculum presented challenges in medicine [12,16,17] and nursing [9,14,18]. In medicine, students and course leaders saw quality improvement as *"extraneous"* and said that there *"was no need to dedicate the amount of time required (for quality improvement) during already harried sessions"* (17). In nursing lack of dedicated time hindered projects [9,18] and in one study students were told that they should only work on improvement projects when 'more important tasks' were complete [14]. Students did not prioritise improvement projects over other curriculum work that they considered more pressing [12,13,15] and perceived the didactic teaching they received on improvement methods as being too lengthy [16,17].

Faculty challenges related to lack of understanding of the improvement training content [9] and working out the logistics of fitting an improvement module into the curriculum without it feeling like an add on [17].

Overall the evidence about undergraduate education on healthcare improvement showed a lack of clarity about which improvement competencies are a priority for healthcare students [4].

The Habits of an Improver

The authors' choice of the word habit was deliberate and was founded on current educational theory [34].

"For knowing something or even being skilled at doing something does not of itself lead to improvement. Only when people habitually and reliably use their knowledge and skills in the real-world context of caregiving will behaviours change. The science of improvement and the art, craft and practices of improving quality require us all to change our habits [2]."

The Habits of Improvers challenges us to address four questions:
1. To what extent is capability for improvement of health and social care services dependent on certain knowledge and skills?
2. Might it be helpful to think of capability for improvement as a set of acquired habits?
3. What do we know about effective methods for developing improvement capability?
4. How can we use an understanding of the characteristics of improving quality to select teaching and learning methods that are most likely to cultivate our desired habits?

The Habits of Improvers has five domains (Figure 1). The domains are explained by considering the special qualities of people for whom improvement really is an integral part of their job [35].
1. Learning: improvers are constantly curious, wondering if there is a better way of doing something. They always want to extract the learning from any experience.
2. Influencing: never content with keeping ideas to themselves, improvers are out there talking to and persuading others that an issue is worth exploring. They have well-honed influencing skills.
3. Resilience: aware of the likelihood of disagreement improvers are prepared for and deal well with conflict. They have a positive mind-set which can remain resilient in the face of inevitable adversity.
4. Creativity: improvers are constantly generating ideas and then inviting critical scrutiny of their thinking. They see strength in collaboration.
5. Systems Thinking: above all improvers see the health and social care systems and all the people who use and help to design them as complex systems.

Pedagogies for getting the improvement habit

There is growing awareness among health professions faculty that how we teach is as important as what we teach [3]. A signature pedagogy is an idea that is potentially useful to all who are interested in learning that builds improvement capability. Signature pedagogy refers to the types of teaching and learning that most suit or match the characteristics of a specific vocational pathway [2,35].

Efforts to transform the preparation of health profes-

Figure 1. The Habits of Improvers framework applied to undergraduate medical education for healthcare improvement. The Habits of Improvers framework is reproduced with permission from a Health Foundation Thought Paper (2). The text about application summarises teaching and learning in the University of Dundee's MBChB curriculum. Text in yellow identifies learning about Healthcare Improvement

sionals in improvement are hindered by faculty's limited expertise in quality and safety science [3], which is also a barrier to undergraduate education about improvement [4]. It follows that developing faculty expertise in improvement and safety science and educating the next generation of healthcare providers need to occur simultaneously [3]. Signature pedagogies for healthcare improvement should be based on co-learning, defined as teachers, students, clinicians, patients and families learning together how care can be improved.

Lucas and Nacer's discussions with educators and experienced improvers led them to add the following complementary and desirable elements into the mix of any signature pedagogy for improving healthcare [2]:

- sustained opportunities to observe critically and be part of improvement activities in a range of health and social care settings
- coaching and mentoring linked to improvement experiences
- peer teaching of techniques and methods
- peer critique using a range of formative methods for giving and receiving feedback
- enquiry-led approaches such as action research.

Assessment: applying the evidence to curriculum content

Evidence from the systematic reviews

The evidence shows that students learn more about improvement through experiential learning by working with clinical teams than from didactic classroom teaching and that students can be a valuable resource for improving healthcare. Success requires support through being embedded in an inter-professional learning cohort with both academic and clinical mentoring. However, there are significant challenges in finding space for learning about improvement within crowded curricula and there is a lack of clarity about which improvement competencies are a priority for healthcare students.

We have provided our students with opportunities to do improvement projects with clinical teams since 2011, beginning with students in Year 5 and then extending to students in Years 2-4 from 2013. Students are supported through the IHI Improvement Practicum and examples of their work are on the IHI website [36]. In 2016 we evaluated the impact of the Improvement Practicum through focus groups with students as well as academic and clinical mentors [37]. Students complete their student selected

components (SSCs) in four week blocks and work on a project in groups. They are supported by a faculty advisor and clinical mentors. Improvement work is identified through a network of consultants, clinical teams and the Patient Safety Team within NHS Tayside. Students work within a multi-disciplinary team, who have been involved in identification of the target for improvement before the students start. They complete IHI online courses at the start of the SSC and have weekly group coaching throughout. Students submit their work to IHI, who award the IHI Improvement Practicum Certificate for satisfactory projects. In addition, the academic mentors complete a structured SSC Assessment for each student on their presentation which is delivered to the clinical team. This focuses on the application of QI methods, team work and feedback from the clinical mentor [37]. The success of the SSCs is evidenced by the publication of previous student projects in peer reviewed journals [38-41].

Getting the Habits of an improver

The Habits of Improvers provides a fresh approach that enables students and faculty to see improvement as a way of working rather than an isolated curriculum component or 'project' [2]. In 2016 we worked with Professor Lucas on applying the framework to improvement in NHS Tayside and the Medical School. Professor Lucas facilitated a Team Based Learning Event in November 2016 with attendees from widely ranging backgrounds including from healthcare, healthcare education, social work, patients, community representatives and students from medicine, pharmacy, nursing and other Schools [42]. Following this event Professor Lucas met with faculty and students from the medical school to agree recommendations for Healthcare Improvement in Dundee MBChB.

1. Develop additional workplace based, service-learning opportunities for Healthcare Improvement at scale for years 1-3 by 2020
2. Provide mentorship and coaching for staff and students, including peer mentoring by senior students
3. Involve people who teach "traditional" curriculum content in the development of learning for Healthcare Improvement.

Workplace based service-learning opportunities for Healthcare Improvement at scale

The Habits of Improvers Framework made us realise that learning about Healthcare Improvement mainly focused on two of the Habits: Influencing and Resilience. Students who do the Improvement Practicum join clinical teams who have already identified a problem and changes that might lead to improvement so the students are not involved in the discovery of the problem or the design of a potential solution. The Habits of Improvers advocates application of the engineering design process to learning about improvement. Engineers move from problem to prototype to testing and back to a more refined under-

understanding of the problem [2]. Good design focuses on discovering the real need before defining the problem and delivering the solution. Good design also explores a range of problems and solutions before selecting the most likely to fulfil the need [43].

We identified patient shadowing and patient experience interviews as opportunities for students to develop the habits of Learning (problem finding, questioning, reflection) and Creativity (team playing, critical thinking, generating ideas, Figure 1). Patient shadowing is a means of improving care experiences by viewing all aspects through the eyes of the patient and family [44]. Patient experience interviews have been developed and implemented extensively over the past 20 years [45] and there is increasing evidence of a positive association between patient experience, patient safety and clinical effectiveness for a wide range of disease areas, settings and outcome measures [46]. In 2015 two of our students enrolled as volunteers with NHS Tayside and were asked to help with collection of patient experience data through interviews with patients discharged from acute care wards [47]. Staff were positive about the results, they perceived the students as trusted interviewers who were independent from the clinical team and the interviews provided faster access to data than mailed questionnaires. The students learned because they got experience of what is going on in the ward, understand how it works, how to speak with patients and understand what they have been through [47].

We have made service-learning our signature pedagogy for Healthcare Improvement (Figure 2). Service-learning occurs when there is a balance between learning and service outcomes so that service and learning goals have equal weight and each enhances the other for all participants [48]. Patient experience interviews began as volunteerism (Table 4), because the students' initial emphasis was on providing a service with no expectations of enhancing their medical studies. However, they concluded that medical schools should consider this type of volunteering as a unique opportunity for medical students to improve understanding of patients' experiences of healthcare, and of how care can be person-centred [47]. Following this successful pilot work [47] we have developed three new curriculum elements, which we have classified as Community Service, Field Education and Service-Learning (Table 4). Community Service is provided by enrolling larger numbers of students from Years 2 and 3 to collect patient experience data. They gain valuable experience but there is no structured learning. In contrast, Field Education is provided by enabling all students in Year 2 to shadow a patient through a medical outpatient clinic, record touch points with staff and conduct a patient experience interview. The students write a reflective case discussion, which is assessed as part of their Year 2 portfolio. The information that they collect is fed back to NHS Clinical Governance for dissemination to the teams but the primary purpose is to enhance the

students' understanding of the Doctor as a Professional. Service-Learning is provided by a Selected Study Component on Person-Centred care when students spend four weeks with a clinical team. They collect data through patient shadowing and interviews and participate in facilitated feedback to clinical teams and discussion about changes for improvement. We are connecting student work on discovering problems and defining solutions with work on developing and delivering improvement by enabling other students to work on an improvement project, including inter-professional team working with design students [49]. Medical and Design students have work with clinical teams to improve the patient's experience creating info graphics focusing on the patients' journey through the department and identifying who the healthcare professional team are and the colour of the uniform they wear. Signage was created to ensure patients could find their way easily to different parts of the department [49]. Here students apply creative and design thinking approaches to problem solving, supporting a process of iterative development and ideation that builds on empathy with service users to design solutions.

Mentoring and coaching students and staff with peer mentoring by students

Our ambition is that *"students and their clinical teachers become co-learners working together to improve patient outcomes and systems of care* [3]*"* but we still have some way to go. We have evidence that students are valued within clinical teams as bringing fresh eyes and new ideas [50]. However, students lack experience and credibility to challenge and influence decisions. They may perceive themselves to be *"only medical students"* [47]. Students collecting patient experience data sometimes find that practitioners do not know who they are, know nothing about the project or how they could help. Consequently these students did not really feel part of the team [47]. We are addressing these issues by developing our Faculty through the establishment of a Quality Management Directorate with Safety and Quality Fellows and Improvement Advisors who will help link students into improvement work across the organisation.

We are developing capacity for peer mentoring students through a student led Healthcare Improvement society, which is led by students who have graduated from a BMSc in Healthcare Improvement [51]. A BMSc is an intercalated degree that allows students to take a year out from their medical degree and provides them with a unique opportunity to study a topic in depth. Students who have graduated from the BMSc in Healthcare Improvement have worked with a clinical team on doing an improvement project and on using research methods to study the barriers and facilitators to improvement.

Involve people who teach "traditional" curriculum content

Service-learning is our signature pedagogy for health-

care improvement but other pedagogies are vital for our students to acquire the habits of improvers (Figure 1). All of our Year 2 students have participated in 26 hours of core learning activities on Healthcare improvement and Human Factors before they undertake any service-learning with clinical teams [50]. These activities have been developed with colleagues who lead curriculum content on inter-professional learning [52], social and behavioural sciences and simulation [53]. Colleagues are developing service-learning opportunities outside healthcare, for example by enabling medical students to work with primary school teachers to develop learning resources about health promotion and first aid for schools [54].

Reflective practice is enabled and assessed in our curriculum, through a portfolio, which is a collection of work that can be used to demonstrate progress and learning. Whilst the written and practical exams can measure what the student knows, these tools do not easily assess professional behaviours. The portfolio enables assessment of higher order skills such as self- reflection, critical thinking and clinical reasoning [55]. Patient shadowing and adverse event reporting are now core elements in the portfolio [56]. However, the portfolio has additional opportunities for developing Habits of Improvers because assessment of students' professional response to feedback on their performance in the curriculum enables them to demonstrate accountability, responsibility and appropriate response to feedback [57]. Assessment of Insightful Practice (engagement, insight and appropriate action for improvement) has been shown to offer a robust system, in general practice, to identify concerns in doctors' response to independent feedback [58,59] and this approach can be applied to assessment of students' reflection on their progress in the curriculum [57].

In the UK the Faculty for Medical Leadership and Management (FMLM) is pushing for leadership and management to be included in undergraduate medical education [60]. An indicative undergraduate curriculum is being developed based on the Clinical Leadership Competency Framework (Table 3).

There is considerable overlap between the Habits of Improvers (Figure 1) and the Clinical Leadership Competency Framework [61. David Black, Medical Director of the Joint Royal Colleges of Physicians Training Board, was interviewed about education for improving quality during the development of Habits of Improvers. He argued that medical leadership is actually all about change: 'Clinical leadership is the ability to influence others to bring about better outcomes for patients' [2]. We believe that acquiring the Habits of Improvers in the first three years of the curriculum will enable our students to develop their medical leadership competencies before they graduate.

Recommendation: make Healthcare Improvement integrated but visible within a connected curriculum for medicine

Table 3. Five domains of the Clinical Leadership Competency Framework. Each domain has four elements. NHS Leadership Academy 2011 [61].

1. Demonstrating Personal Qualities • 1.1 Developing self-awareness • 1.2 Managing yourself • 1.3 Continuing personal development • 1.4 Acting with integrity 2. Working with Others • 2.1 Developing networks • 2.2 Building and maintaining relationships • 2.3 Encouraging contribution • 2.4 Working within teams 3. Managing Services • 3.1 Planning • 3.2 Managing resources • 3.3 Managing people • 3.4 Managing performance	4. Improving Services • 4.1 Ensuring patient safety • 4.2 Critically evaluating • 4.3 Encouraging improvement and innovation • 4.4 Facilitating transformation 5. Setting Direction • 5.1 Identifying the contexts for change • 5.2 Applying knowledge and evidence • 5.3 Making decisions • 5.4 Evaluating impact

Table 4. Distinction between Service-Learning and other service programs with examples applied to medical edcation on healthcare improvement . Adapted from Furco [48].

Recipient (patients, public or professionals) ◄——— BENEFICIARY ———► Provider (students)

Service provided by students ◄——— FOCUS ———► Learning by students

SERVICE-LEARNING
Service-learning programs intend to equally benefit the provider and the recipient of the service with equal focus on both the service being provided and the learning that is occurring.

Examples: facilitated feedback to clinical teams and patients (Discover); working with teams and patients to narrow down options (Define); Develop and Deliver solutions (improvement practicum; Global Health Challenge)

COMMUNITY SERVICE
The engagement of students in activities that primarily focus on the service being provided by the students as well as the benefits the service activities have on the recipients. The students receive some benefits by learning more about how their service makes a difference in the lives of the service recipients.

Examples: collection of audit or patient experience data for clinical teams without structured learning.

FIELD EDUCATION
Students perform the service as part of a program that is designed primarily to enhance students' understanding of a field of study, while also providing substantial emphasis on the service being provided.

Examples: collection of individual patient experience or adverse event data with reflection on personal learning and service improvement.

VOLUNTEERISM
The engagement of students in activities where the primary emphasis is on the service being provided and the primary intended beneficiary is clearly the service recipient.

Example: volunteering to sit with patients who need some company

INTERNSHIP
Programs that engage students in service activities primarily for the purpose of providing students with hands-on experiences that enhance their learning or understanding of issues relevant to a particular area of study.

Example: clinical patient contact, observation of clinical teams and patients in practice with reflection on personal learning

The realist review from Jones et al. [5] informed a conceptual framework that highlights that the learner inhabits two connected worlds. The educational world of the curriculum and teachers and the clinical world of the inter-professional team and the patient and family. These two worlds involve different learning experiences as students build knowledge, develop skills and professional attributes as they progress through their educational programmes [5] and develop into effective lifelong learners and improvers.

Frameworks such as the connected curriculum [62] provide an opportunity to make the intersection between learning in educational and clinical worlds more explicit to both teachers and learners. The core principle of the connected curriculum is that all students have much to gain by actively learning through research and enquiry and that this can be supported by domains of practice. These domains include students connecting academic learning with workplace learning, students connecting with each other and across phases, students connecting with staff and their research and students making connections across subjects beyond the walls of the university. Making these connections more explicit and using them to inform curriculum design aims to equip students for a world of work that has ever changing needs, where they are able to apply knowledge and skills to practice and in turn to inform, create and implement change and make meaningful contributions to society. The connected curriculum also seeks to provide opportunities for students to make interdisciplinary connections and address complex challenges.

Many of the healthcare improvement educational approaches that we have developed and implemented at Dundee align with dimensions of the connected curriculum. Creating patient shadowing opportunities, situating students in inter-professional clinical teams to develop improvement projects helps develop research skills. Working on problems with design students enables medical students to gain insights into new disciplines and their ways of thinking and habits of mind as does the university's annual Global Health Challenge [63] where students from across all academic disciplines work with local community groups to tackle and creatively address complex health related problems. We believe the connected curriculum provides a helpful framework on which to hang the signature pedagogy of service learning. It may also be helpful to consider the role that different teaching perspectives [64] can play to further inform the development of a connected approach to healthcare improvement education across the continuum of healthcare profession education. Pratt [65] describes five teaching perspectives which support transmission; the development of meaning by introducing learners to new ways of thinking through problems; apprenticeship learning on authentic tasks in clinical settings; nurturing that helps learners develop personal agency and self-efficacy and a social reform perspective where good teaching aims to change and improve medical practice. We believe each of these teaching perspectives has the potential to be applied to the habits of an improver model and signature pedagogies for improving healthcare as outlined above [2] and be used to help map the student learning journey through a connected curriculum that supports learning in the overlapping world of the educational institution and the clinical world [4].

Abbreviations

MBChB: Bachelor of Medicine and Bachelor of Surgery; MSc: Master of Science; QI: Quality Improvement; SQUIRE: Standardised quality improvement reporting excellence guidelines; SSC: Selected study component; USA: United States of America.

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Conflicts of Interest

The authors declare no conflicts of interest.

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