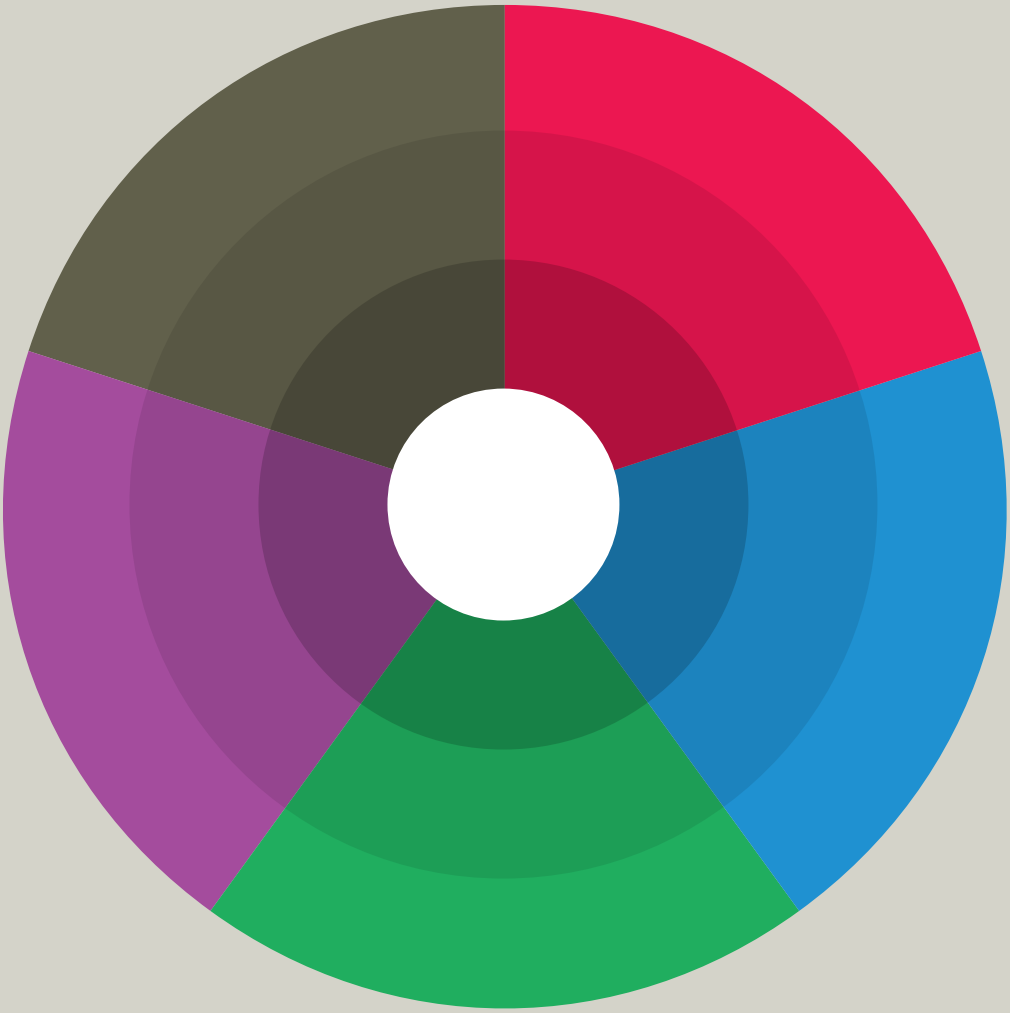
The Health Foundation

The habits of an improver

Thinking about learning for improvement in health care

Bill Lucas with Hadjer Nacer



Thought paper

October 2015

For several decades we have known about the importance of education which builds improvement capability. But, looking across the professions and occupations that plan and deliver health and social care services in the NHS, it is clear that there is too much variation in the quality and scope of provision.

While some health and social care professionals receive formal training for improvement, many receive nothing, either as part of their initial training or as subsequent professional development. There are no common approaches with regard to the desirable behaviours of those working in health care or the kinds of knowledge and skill domains which are helpful, or the learning methods which are most effective.

At a time of heightened interest in education and training, this paper offers curriculum designers and all those providing initial or continuing professional development a new way of thinking about education for improvement.

About the authors

Bill Lucas is Professor of Learning and Director of the Centre for Real-World Learning at the University of Winchester. He is well known for his research into vocational pedagogy, learnable intelligence and creativity and is the author of many books and papers on these topics. Bill advises organisations across the world on learning strategy including the Mitchell Institute in Melbourne and the Vinnvård Foundation in Stockholm. With colleagues at the Health Foundation he played a key role in creating the Improvement Science Fellowship scheme.

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Foreword

The Health Foundation is pleased to publish this contribution to current debate about how best to educate, train and develop the skills of health and care professionals to enable them to improve the quality of services. The past few years have seen increasing interest in improving quality as part of the professional role, which is a great step forward in itself. We are aware of the rise in formal and informal training opportunities that are now available, from modules in initial professional training, to Masters level degrees and short in-service courses. We want to ensure that our contribution best complements what is offered by universities, statutory training bodies and NHS organisations.

While there are many courses that focus on particular approaches, competencies and skills, the unique contribution that Professor Bill Lucas brings to this arena is to suggest that we instead think about what attributes individuals need to foster if they are to be able to succeed with bringing about change and improvement in the quality of care and services. The current paper builds upon extensive work by Bill and others, in engineering and elsewhere, with the aim of ensuring that individuals are able to reflect upon, communicate and collaborate to shape further national and local activity.

Continuous improvement is a key principle of the Foundation and is supported by the perspective outlined in this thought paper, namely, the importance of defining and consciously developing the habits that enable and facilitate improvement as a key professional skill. Such an understanding is crucial in the development and implementation of education and training to help individuals to become successful improvers in the complex world of health and social care.

The key ideas in this paper will be taken forward with relevant partners to influence the future direction and approach to training in this important area. While recognising that individual aptitudes and habits of mind are critical, they need to be actively developed, supported and reinforced by the way in which improvement interventions are designed, planned, implemented and evaluated.

Professor Nick Barber
Director of Research, the Health Foundation

Executive summary

Improving the quality of care services is an imperative for the NHS. For this to happen systematically a substantial proportion of those working in health care need to be committed to learning and changing, as well as capable of implementing and sometimes leading improvements.

Over the last three decades the idea of improving quality has taken root across the world. In parallel the field of improvement science is becoming established in healthcare services. Drawing on many disciplines and adopting tools and processes from a wide variety of sectors, improvement science and 'improvement' are increasingly taught at post-graduate level. But still many doctors and nurses in the NHS become qualified with only the scantest experience and knowledge of the theories and practices of improvement. The development of courses in improving quality and the realisation that the science of improvement is a very broad field has led to a proliferation of new topics, ideas and methods for possible study.

The habits of an improver offers a way of viewing the field of improvement from the perspective of the men and women who deliver and co-produce care on the ground, the improvers on whom the NHS depends. It describes 15 habits which such individuals regularly deploy, grouped under five broad headings – learning, influencing, resilience, creativity and systems thinking. It goes on to suggest that there is a 'signature pedagogy' of improving quality, that is to say that there are certain teaching and learning methods which best develop capability in understanding and implementing improvement.

This five dimensional model of improvement is **not** an alternative to the knowledge and skills which those working in health care also need to have in relation to undertaking improvement. Rather it is complementary, a means of ensuring that those developing curricula maintain a holistic overview and think carefully before simply adding in another area of content or suggesting a new skill.

The choice of the word habit is deliberate. 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. And so starting with the habits we desire as outcomes of all learning in the NHS allows us to begin with some true ends in mind.

The habits of an improver has been written to promote discussion and as a possible model for all those seeking to take decisions about the best balance of attitudes, skills and knowledge in initial training and continuing professional development for improvement across the NHS and with our international friends and partners.

1. Introduction

> *'The NHS should continually and forever reduce patient harm by embracing wholeheartedly an ethic of learning.'* (Berwick Report, 2013)[1]

Across the world it is becoming apparent that the education of health care professionals, both initially and then throughout their careers, does not adequately equip them for today's and tomorrow's ever-changing health care settings.[2] Specifically it does not ensure that everyone has both the confidence and capability to engage in continuous quality improvement.* As we understand more about the science of health care improvement we are also realising that our thinking about curriculum development and our approaches to pedagogy need reappraising.

The habits of an improver is a practical thought-piece in which we explore some of the issues facing those who want to make a reality of Don Berwick's recommendation above. Specifically we explore the kinds of mindsets which are conducive to improvement, the knowledge and skill domains which are important and the best methods for acquiring all of these. We offer a way of framing the conversation about learning for improvement capability through the lens of five desirable improvement habits. We hope that these habits might be useful to those seeking to design and offer education for improving health and social care, whatever the context in which they find themselves.

Rising demand for efficiency and effectiveness in health services with increasingly limited resources puts health care systems under significant and continuous pressure. At the same time health care services need to keep pace with medical and technological advances and deal with an ageing population, often in poor health.

These challenges are forcing all those involved with health care to rethink delivery models, moving, for example, towards the co-production of health care services, inviting a fundamental rethinking of the relationship which health care professionals have with users and with their communities. We will need significant changes. As Paul Batalden and Frank Davidoff put it: 'Healthcare will not realise its full potential unless change making becomes an intrinsic part of everyone's job, every day, in all parts of the system.'[3]

If we are to make the improvement of quality a core activity of everyone in the NHS, we will need to be much more precise about the aspects of change making which are required. We need to be clear about how improvers think and act and what they need to be able to know and do. At the practical level we will want to understand when and how people working in health care should undertake specific aspects of education and training for improvement, where this should take place and whether it should be mandated and accredited.

The recognition that learning is closely linked to improvement is hardly new. A number of studies describe the positive connection between organisational learning and performance.[4,5] For several decades we have known about the idea of the learning organisation through the work, for example, of Peter Senge[6] and Chris Argyris.[7]

During the second part of the twentieth century it became increasingly clear that it was possible to improve, systematically, the quality of products and services. The movement to address quality took root in various manufacturing industries, often inspired by the work of W Edwards Deming. In particular, improvers were influenced by his System of Profound Knowledge.[8] They began to appreciate how a deep understanding of four key inter-related areas – appreciation for a system,

* Throughout this paper we have used the phrase improving quality and occasionally 'quality improvement' rather than its now widely used acronym, QI, which, for some, has too narrow a focus.

knowledge about variation, theory of knowledge and psychology – could help organisations to improve. Other approaches such as 'lean', 'kaizen' and 'six sigma' were also created for the purposes of improving processes in a range of industries. In the last decade we have begun to appreciate how many more disciplines can contribute to the improvement of care services.

Reviewing the lessons learned from the failures of care at Mid-Staffordshire, the Berwick Report concluded that the answer to the problem of unnecessary harm in the NHS was the creation of 'an ethic of learning'. Yet there is little specifically in the strategic overview published by the NHS as to how learning will be central to the NHS in the next five years.[9] As The King's Fund suggests, 'National bodies should develop a strategy for quality improvement and leadership development for the NHS in England to enable it to become a learning organisation.'[10]

The body in England charged with the oversight of the implementation of learning, training and education is Health Education England (HEE). But within HEE it is hard to find a coherent strategy with regard to the role of learning in improving health care services. The Research and Innovation Strategy[11] comes closest, with its focus on creating an education and training system that is 'evidence based and underpinned by research and innovation' and building the 'capacity and capability of our current and future workforce to embrace and actively engage with research and innovation'.

Specific HEE objectives refer, for example, to 'education and training which will facilitate and sustain the organisational and cultural changes required to embed research and innovation', but it is not clear precisely what these are and how they are being delivered.

There are a number of bodies responsible for the initial training and continuing development of individual professional groups, such as, for nurses, the Royal College of Nursing and, for doctors, the Academy of Medical Royal Colleges. Both these bodies are exploring ways of embedding learning and leadership to improve quality.*

So why is it apparently so hard for the NHS to take learning seriously and for improvement to become the watchword of everyone in the service when it has so explicitly been linked to reducing harm? There are many reasons. Lack of time, lack of resources, lack of understanding and lack of confidence are just four typically given.

But we wonder whether there is something else of note going on here. Perhaps 'improvement', like 'learning', is just too big a concept for people to comprehend? As a consequence, therefore, improvement tends to become 'an improvement project'. Or, at an even more precise level, a single plan-do-study-act (PDSA) cycle.

Recently the Health Foundation, with NHS England, has created Q, an initiative deliberately attempting to upscale the development of improvement capability.[12]

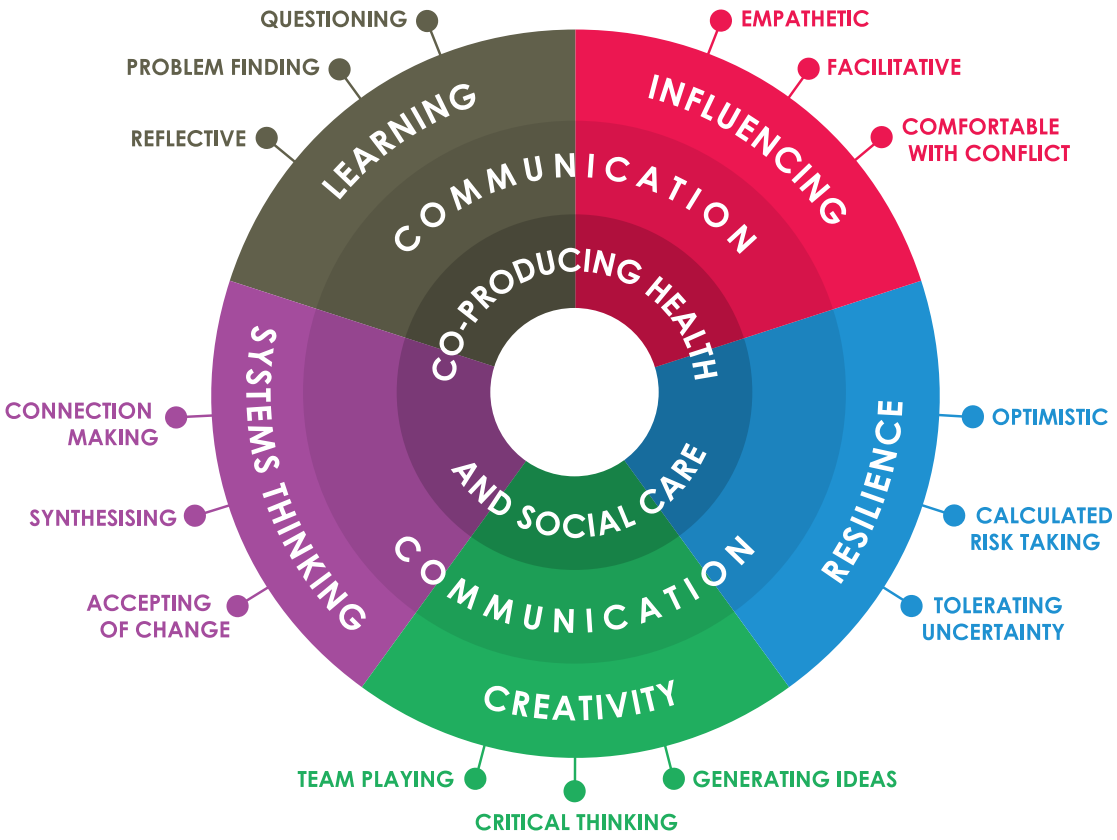
Box 1: Q – a learning network to accelerate and deepen capability in improving quality

Q is an initiative, led by the Health Foundation and supported and co-funded by NHS England, connecting people skilled in health care quality improvement across the UK. Q aims to create a dynamic learning community that will accelerate and deepen learning and change, by bringing people together around shared challenges and providing ways to connect and share knowledge and develop skills and support change efforts.

* Work currently underway by the Joint Royal Colleges of Physicians Training Board is creating new opportunities for introducing learning about improving quality in undergraduate and post graduate medical training.

The habits of an improver draws on a mainly psychological literature* and offers a way of framing conversations about improvement and learning that see the concept of improving health and social care as five broad interlocking habits to do with learning, influencing, resilience, creativity and systems thinking (see figure 1).

Figure 1 – The habits of improvers



At the centre of the figure is the goal of the NHS which we depict as the co-production of health and social care. In the middle we highlight the importance of communication in improvement. Outside this are the five habits and, attached to the outer ring, are the 15 sub-habits.

On pages 12–15 we explore these habits in more detail. While each habit has its three sub-habits, in practice many of the categories are permeable. By the same token, while we have implied that a sub-habit is only related to one of the five habits, there is much more flexibility than this in the real world of the NHS.

To help educators reflect on the challenge of building improvement capability, in box 2, we offer a 'theory of change'. In it we suggest why we think framing the range of improvement activities as a set of improvement habits might help us better specify desired outcomes and more effectively select most appropriate learning methods.

* This includes but is not limited to the work of Lauren Resnick, Art Costa and the Centre for Real-World Learning at the University of Winchester – www.winchester.ac.uk/realworldlearning

Box 2: Theory of change for building improvement capability in the NHS

If:

- we clearly articulate the range of habits which improvers need to have, and
- the knowledge and skills which will help them improve care

then:

- we can more precisely specify the learning required, and
- the kinds of methods which are most likely to be helpful, and
- the best times for this learning to take place

so that:

- learning to build improvement capability becomes more widespread, and
- more people want to change their practices, and
- more people want to and have time and support to undertake learning, and
- leaders value learning and ensure that it is applied systematically

so that:

- the NHS embraces an ethic of learning, and
- the experiences of all patients and service users are improved, and
- considerable value is created for all those who create, deliver and use NHS services.

Note: Here we have drawn on approaches to articulating theories of change in Davidoff F, Dixon-Woods M, Leviton L et al. Demystifying theory and its use in improvement. *BMJ Qual Saf* 2015;0:1–1.

The theory of change has four elements, each of which needs a few more words of explanation.

- By articulating a set of habits it becomes easier to decide which techniques or skills and what knowledge needs to be learned rather than simply creating an ever-longer list of improvement methods. The frame becomes a means by which conversations can be had between those working on the front line and curriculum and course developers to understand needs better.
- Once the learning has been specified it is possible to have more informed conversations about which teaching and learning methods are likely to be most effective. Professional bodies will then need to consider the timing of any learning, whether it is part of initial training and certification or ongoing professional development (and, potentially, revalidation).
- If communication, central to the 'habits of improvers' model shown in figure 1, is truly effective and if those who lead the NHS can create the conditions in which learning can flourish, then improvement capability, hand in hand with ongoing learning, should be cultivated.
- And – a big 'and' – through people's lived experiences of an 'ethic of learning', value is ultimately created.

2. The science and practices of improvement

> *'The remarkable achievements of modern healthcare make the deficiencies associated with delivery of care all the more noticeable.'* (Martin Marshall, Peter Pronovost and Mary Dixon-Woods)[13]

In the last two decades our knowledge and understanding about how to improve health care services has expanded hugely. Phrases such as 'evidence-based medicine', 'quality improvement', 'translational gap', 'knowledge mobilisation' and 'implementation research' have entered the discourse to suggest a view of improving health care that is better grounded. As well as being founded on medical research, improvement, it is now recognised, needs to draw on thinking from many disciplines.*

Box 3: Four definitions of improvement science in health care

'Improvement science is an emerging concept which focuses on exploring how to undertake quality improvement well. It inhabits the sphere between research and quality improvement by applying research methods to help understand what impacts on quality improvement.'
The Health Foundation, www.health.org.uk

'The primary goal of this scientific field is to determine which improvement strategies work as we strive to assure effective and safe patient care.'
Improvement Science Research Network, http://isrn.net/

'We describe improvement science as a way of utilising the benefits of science – a way of knowing that produces generalisable knowledge through systematic observation or experimentation – to improve decisions about how healthcare is organised and delivered.'
Improvement Science London, www.islondon.org

'The science of improvement is an applied science that emphasizes innovation, rapid-cycle testing in the field, and spread in order to generate learning about what changes, in which contexts, produce improvements. It is characterized by the combination of expert subject knowledge with improvement methods and tools. It is multidisciplinary – drawing on clinical science, systems theory, psychology, statistics, and other fields.'
Institute for Healthcare Improvement, www.ihi.org

It is worth noting, too, that in other public services such as education there is a similar interest in more rigorous approaches to improvement:

> *'Improvement science is explicitly designed to accelerate learning-by-doing. It's a more user-centered and problem-centered approach to improving teaching and learning.'* (Carnegie Foundation for the Improvement of Teaching and Learning, www.carnegiefoundation.org)[14]

* Recently the terms 'improvement science' or 'the science of improvement' have increasingly been used to describe this broader field. The longer form of these two phrases is generally attributed to Gerald Langley and colleagues in his book *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*, first published in 1996. Today the phrase 'improvement science' is increasingly used to describe this broad and emergent field in health and social care.

In the last decade there has been an increasing awareness that the NHS needs to adopt both the science and practices of improvement in a more systematic way. In recent times agencies have been created to act as catalysts to such efforts – NHS Institute for Innovation and Improvement and NHS Improving Quality are just two examples. These organisations have amassed much understanding and many tools for improving health and social care. However, as the theory of change on page 9 suggests, the fact that the NHS appears to need them suggests that embedding learning and making improvement part of a normal workload in the NHS is hard.

Recently the focus of improvement has become more local with the formation of Collaborations for Leadership in Applied Health Research and Care (CLAHRCS) and Academic Health Science Networks (AHSNs). CLAHRCS are partnerships between universities and local NHS organisations, focused on improving patient outcomes through the conduct and application of applied health research. Nine CLAHRC pilots were established in 2008, and there are now 13 CLAHRCs around the UK.[15] AHSNs seek to improve patient and population health outcomes by translating research into practice, and developing and implementing integrated health care services.[16] There are currently 15 AHSNs. Like CLAHRCS, AHSNs integrate improvement research and improvement practices. CLAHRCs and AHSNs offer excellent test-beds for practitioners, academics and curriculum developers to develop new thinking about learning for improvement.

In parallel with NHS-led and funded bodies trying to accelerate improvement, there is a plethora of other schemes, national and local, which support individuals to become more adept at the science and craft of improvement. Fellowship programmes offer individuals both formal and informal opportunities to learn about the theory and practice of improvement. The Health Foundation, for example, runs the Improvement Science Fellowships[17] and GenerationQ.[18] Fellowship programmes to develop improvement capability are seen as a useful model across the world.* The Q initiative from the Health Foundation and NHS England is a timely opportunity to learn from these and many other attempts at building capability in individuals for the benefit of the wider system.

* See, for example, *Fellowships at IHI*: www.ihi.org/engage/fellowships/Pages/default.aspx and *Vinnvård Fellows* www.vinnvard.se/fellowship

3. How improvers think and act

> *'Intelligence is the habit of persistently trying to understand things and make them function better. Intelligence is working to figure things out, varying strategies until a workable solution is found… One's intelligence is the sum of one's habits of mind.' (Lauren Resnick)*[19]

As the field of improvement has grown, so too have the many courses on offer, with a profusion of tools and techniques. Talking to those working in health and social care it is easy to see how easily the learning and improvement messages can get lost in translation. For very understandable reasons it is tempting for busy people to think of improvement as just a set of techniques or to associate it with a specific 'improvement project' in their neck of the NHS woods (of which there are many). Reducing what otherwise might seem to be too abstract a concept to practical, deliverable actions is how many in a pressured service have to think and act.

Conceived like this, education for improvement practices can all too easily be reduced to, for example, 'how to use a driver diagram'* or 'how to lead an improvement project'.† Both of these are entirely worthwhile approaches to improvement and both are helpful to learn. The first enables structured logical thinking and decision making and the second equips managers with some useful operating principles. But without a clearer picture of what improvement really looks and feels like, the 'packaging' of improvement can end up becoming its lived reality.

Spend any time with someone for whom improvement is an intrinsic part of their job and you realise that they think and act in different ways from those who are simply set on routine service delivery. Improvers are constantly curious, wondering if there is a better way of doing something. They want to extract the learning from any experience. Never content with keeping ideas to themselves, they are out there talking to and persuading others that an issue is worth exploring. They have well-honed influencing skills. Aware of the likelihood of disagreement they are prepared for and deal well with conflict.

They have a positive mindset which can remain resilient in the face of inevitable adversity. They are constantly generating ideas and then inviting critical scrutiny of their thinking. They see strength in collaboration. Above all they see the health and social care systems and all the people who use and help to design them as complex systems. As a consequence they look to make connections, to build alliances and synthesise ideas in order to gain maximum acceptance of any planned change.

In short, they look to exercise the kind of smart common sense in the real world of providing care services that Lauren Resnick suggests in the quotation at the start of this section. We suggest that starting from the premise that improvement intelligence is a series of habits makes it easier to consider how best to develop them. It may also help to keep a broader overview which prevents mistaking individual interventions for a more holistic strategy.

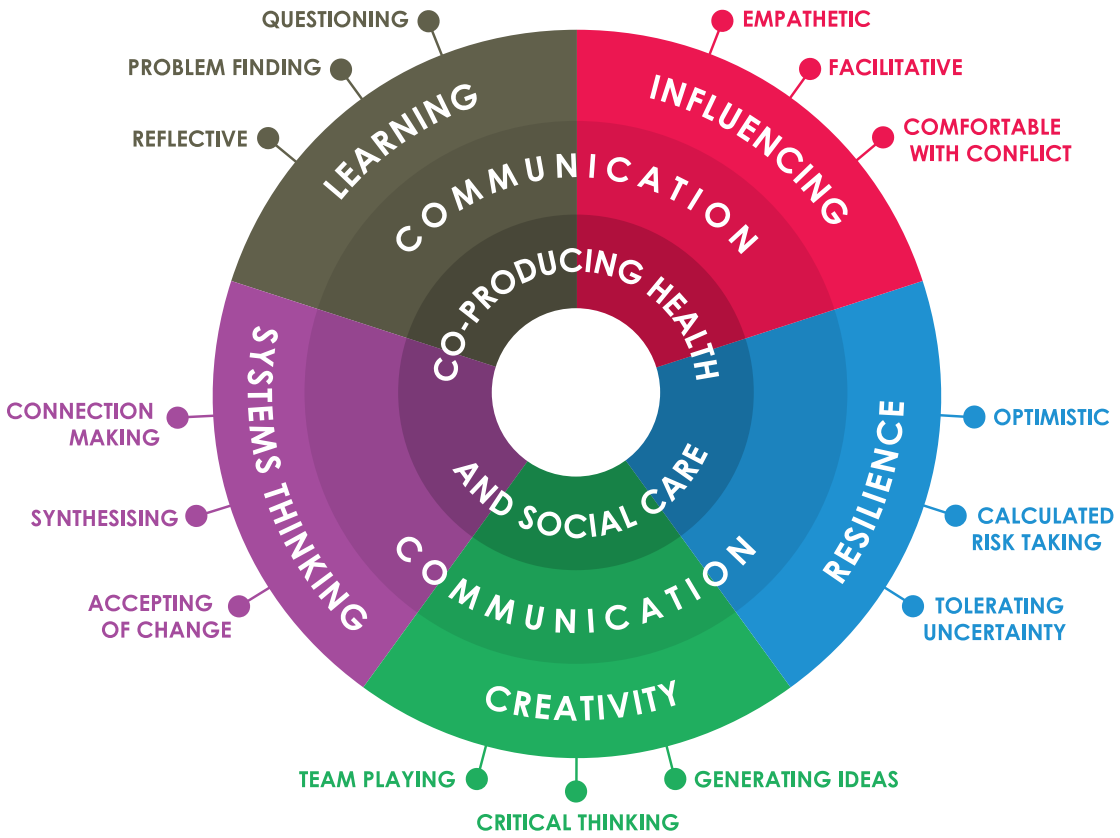
Five dimensions of improvement

Here we offer a fuller description of each of the five habits of improvement, and their associated sub-habits, of the model we introduced on page 8 (see figure 2). Note that the descriptions parallel the description of improvers we offered previously. We do not suggest that all the habits would necessarily be found in any one person or team or even organisation, but they serve as a kind of holistic ideal or type.

* See www.institute.nhs.uk/quality_and_service_improvement_tools/quality_and_service_improvement_tools/driver_diagrams.html for the recent history of the use of this tool.

† See http://careers.bmj.com/careers/advice/view-article.html?id=20010482 for an example of this kind of approach.

Figure 2 – The habits of improvers



Learning

Improvers have a real hunger to make things work better and so reduce the burden of illness and efficiency of care. They see this drive for learning as a moral imperative.

Questioning

Curiosity is central to improvement. Why is this not working? Who else does this better? Where is the best place? Which methods work best? Who says? When is the best time? What can we do differently? What if…? Improvers constantly hypothesise: 'If we do x will y happen more effectively?'. They are not afraid to challenge assumptions and orthodoxies.

Problem finding

When questions are asked and attention is given to specific contexts, issues and problems in need of fixing begin to be identified. Problem finding requires individuals to investigate, check and cross-check using both intellect and intuition. They need to be able to reframe a possible problem to check whether they are dealing with a symptom or a cause. Sometimes it is helpful to problematise in order to require a solution to an issue.

Reflective

Improvers are reflective practitioners, comfortable using a range of evaluative methods to better understand whether changes are improvements or not. Reflectors are able to learn from experiences both in the moment and systematically over time taking multiple perspectives on their own actions.

Influencing

Improving anything is almost always a social project requiring buy-in and engagement from others. It requires people who can engage others in their cause, framing their efforts to attract people, resources and energy.

Empathic

To influence people you need to understand them. An essential part of such understanding is the ability to 'read' them, to see where they are coming from, what their needs, ambitions and fears are. Empathy requires an individual to see things through others' eyes, walk in their shoes and value and seek to understand different perspectives.

Facilitative

Facilitation involves selecting and using processes which enable people to share ideas, understand issues, consider evidence and take decisions well. Being facilitative requires an individual to be able to establish shared goals, work within different contexts, keep focus, deal with feelings, manage disagreements and stick to time. It assumes that, as well as working well together, people will constantly seek to learn from their experiences.

Comfortable with conflict

Changing anything – a goal which is at the heart of any improvement activity – frequently brings with it conflicting points of view. People who are comfortable with conflict expect it to occur. They are able to disentangle feelings from facts, opinions from evidence, and behaviours from personality. They expect there to be levels of uncertainty and ambiguity in all complex systems and situations.

Resilience

Adaptation and the ability to bounce back from adverse events are core to improvement. In everyday settings resilient individuals seek, foster and notice reliability, actively learning from variation. Simple or even complicated situations call on reliable responses, but many things in health are inherently complex and call on adaptation.

Optimistic

Remaining positive means an individual is able to remain detached from events to the extent that they are separated from him- or herself (not personalised), temporary (not a permanent setback) and clearly bounded (not allowed to become pervasive across other areas of life). Improvers have a 'growth mindset', recognising that believing that they can improve is an active ingredient of being able to improve.

Calculated risk taking

All actions have desirable or undesirable outcomes. Dealing with risk is part of being alive and human beings would not have evolved if they had not taken risks. If anything is to be improved or changed it will bring with it a degree of risk. Improvers are adept at taking reasonable risks – playing with possibilities and daring to be different. Improvers will want to ensure that value and safety are carefully weighed against any possible risks. Not taking a decision can be a greater risk than taking one.

Tolerating uncertainty

Almost everything in life is uncertain. In complex systems there will always be degrees of ambiguity. Improvers draw strength from creative tensions, emerging evidence bases and new ways of thinking and acting. In any new situation improvers see the value of openly discussing the degree to which it is possible to be certain and then managing their own and others' expectations about what a reasonable level of uncertainty would be. They also recognise that different people have different levels of tolerance and these need to be acknowledged but not necessarily regarded as fixed.

Creativity

Creativity is an important part of improvement processes. Creative problem solvers draw on a wide range of traditions and disciplines to design the techniques and processes they use that are most likely to encourage fresh thinking. Problem solving sometimes needs to precede improvement activity.

Generating ideas

Improvers play with possible futures, imagining 'what if?'. They have a range of techniques for coming up with new ideas in different contexts. Improvers recognise the value of trying new things, of thinking slow and fast, of reading as a stimulus and of socialising with many different people.

Critical thinking

Critical thinking is the art and craft of using reason to think well. Critical thinkers have thinking routines which are useful in different situations. These include ways of getting at propositions and the justifications for opinions, questioning that leads to deeper inquiry, encouraging active reasoning and explanation, understanding different perspectives, reflecting on how and why thinking changes and an instinct to look beyond current contexts.

Team playing

Improvers recognise the value of other people's ideas and the value of different perspectives when harnessed to explore specific issues. They understand the need for different team roles in collaborative activity. They are skilled at giving and receiving feedback, recognising the importance of choosing words carefully when giving advice ('you might like to…' as opposed to 'you should…'). They have a mindset which recognises the value of sharing ideas at all stages of any improvement process and are generous with their own time with others.

Systems thinking

Seeing whole systems as well as their parts and recognising complex inter-relationships, connections and dependencies is critically important. The interdependent nature of health care service work is one of its core properties – as is its diversity.

Connection making

Very few thoughts are genuinely original and, consequently, it is in the combination of different thinking and the application of activity from one context in a new one that improvement tends to take place. The process of connection making requires individuals to use metaphors, think out loud, deliberately play at alternate uses, visualise and prototype.

Synthesising

Synthesising thinking creates order out of chaos, allows patterns to emerge, makes sense of data and experiences. Synthesising processes include reordering, recombining, retelling, applying different analytical frames and translating. Above all it starts from the belief that in a complex system multiple and often inter-connected disciplines will have a helpful contribution to make to building understanding.

Accepting of change

All change is based on the aim of improvement. Effective improvement has a theory of change underpinning it by which its processes and outcomes can be evaluated. Given that the human mind loves patterns and habits of thought, improvers see the necessity of breaking out of routines. They recognise that this can bring with it defensive or even hostile reactions and plan accordingly when dealing with others, always mindful of the fact that this will apply to them too.

A question of re-engineering?

Thinking about education for improving health and social care, it seems to us, is not wholly unlike thinking about engineering and the kinds of education that will produce great engineers. In the UK, there is a widely held view that we are not producing enough engineers. At first glance, this is a supply and demand problem similar to the one facing the NHS, where we do not yet have enough people with improvement capability.

The Centre for Real-World Learning[20] (CRL) recently worked with the Royal Academy of Engineering to suggest a different way of thinking about engineering and engineering education. Rather than accepting the supply and demand analysis, CRL sought to reframe the problem as a lack of understanding of how engineers actually think and act – their engineering habits. A simple three-stage theory of change went:

If:

- engineers can better articulate their characteristic engineering habits of mind

then:

- the education system can be redesigned to cultivate these engineering habits of mind better

so:

- that the UK produces more engineers.

Six core engineering habits of mind were developed and validated:

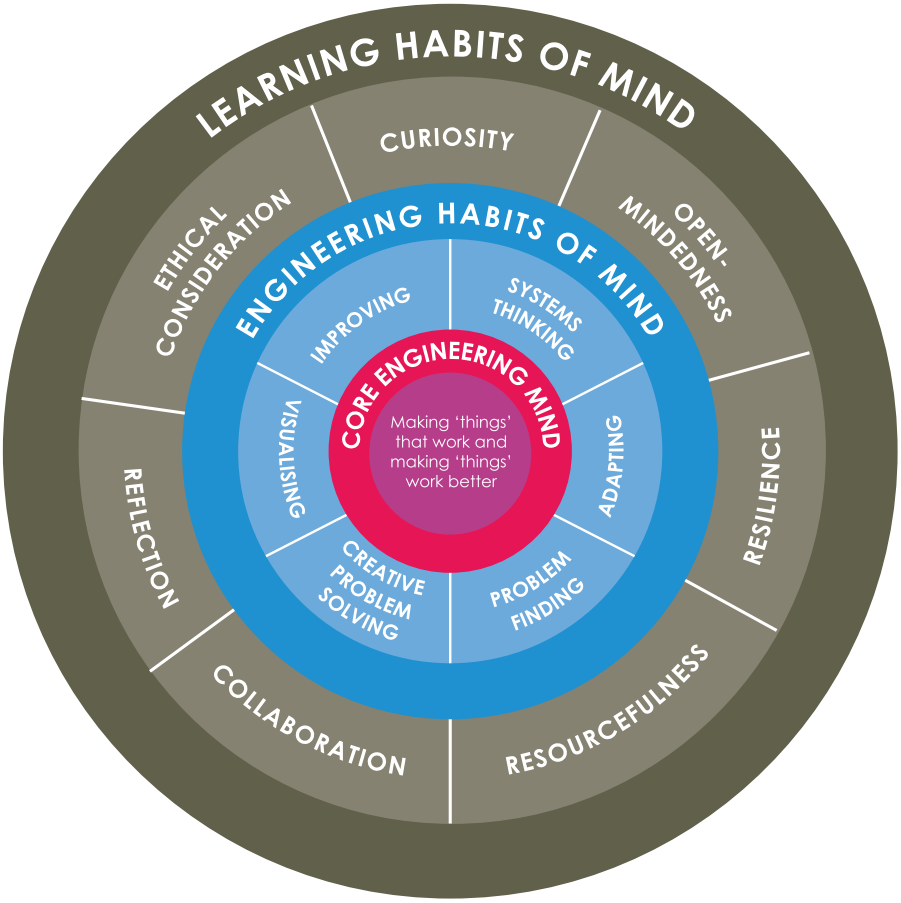
- Improving
- Visualising
- Creative problem solving
- Problem finding
- Adapting
- Systems thinking.[21]

As shown in figure 3, these were then represented diagrammatically as the blue middle ring, with more generally useful learning habits in the outer circle and the central goal of engineering in the 'bull's eye'.

Depicting engineering in this way created three useful opportunities for engineer educators:

- With a greater precision of desired outcomes (the six habits) it is much easier to think about the teaching and learning methods which might cultivate them.
- The six habits enable engineers to become much less 'tribal', worrying less about whether they were talking about, for example, mechanical, electrical, structural or chemical engineering.
- The habits approach facilitates dialogue between engineers from different branches of engineering and those who are developing curricula.

Figure 3 – Engineering habits of mind[21]



We suggest that, while not being an exact proof of concept for the transferability of our model of improvement habits, the engineering example offers some promising thinking for the NHS as it seeks to specify education for improving quality.*

With an approach to improvement based on habits it might be easier in the NHS to:

- focus more closely on the teaching and learning methods which work best for building improvement capability
- help different clinical, professional and patient groups to find common approaches
- facilitate dialogue about learning for improvement between course designers, educators and those delivering care services.

Essential to this kind of thinking is the idea that habits are learnable, for which there is a growing literature.[22] They can be cultivated, practised, reinforced, encouraged. This is the role of leadership in selecting educational strategies which will bring about desired habit change at scale, as we explore in the next section.

* The idea of seeking to understand a complex set of concepts through a 'habits of mind' approach has been used in a number of different contexts, for example, in mathematics, in science and in education more generally: see Annex 1.

4. Pedagogy for improvement

> *'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…' (Molly Cooke, Pamela Ironside and Gregory Ogrinc)*[2]

In the UK and across the world there are growing numbers of academic and health care centres seeking to provide education which is beyond certification or re-validation but more broadly designed to develop capability for improving quality. These are both pre- and post-graduate, certified and uncertified, and explore improvement research, methods and practices in a broad range of health and social care settings.

In the UK there are currently 37 accredited post-graduate courses (MSc, Diploma, Certificate) on the Universities and Colleges Admissions Service (UCAS) database[23] which purport to teach aspects of improving quality in health care – although course descriptions are notoriously generic and UCAS listings are constantly changing. The field of improving quality is also broad and open to interpretation. But even with those interpretive cautions, it is clear that there are a significant number of courses to choose from. Later we will offer a few examples of approaches which promote the kinds of habits we are suggesting and are not the narrow didactic sessions referred to in the quotation above.

But before we do so let's return to the issue we raised in our earlier theory of change and have been exploring throughout this piece. It breaks down into four inter-related 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?

Knowledge, skills and habits?

It may be useful to think more about the three components – knowledge, skills and habits. This will begin to explore our first two questions, which need to be considered whatever vocational curriculum is being designed. Let's take the very real example of learning about the importance of hand washing in hospitals to illustrate the inter-relationships between these different elements.

In terms of knowledge you need to understand the basic science of infection and then to be clear about the different impact of, for example, sanitising gel or soap and water.

In terms of skill, cleaning hands is a relatively simple one to acquire, but there may be specific learning about, for example, using enough soap, thorough hand drying or not touching taps with unclean fingers.

So far so good. But in terms of learning for quality improvement it is important to remember that we have known about the importance of hand washing in reducing infection since the 1850s through the work of Ignaz Semmelweis and subsequently Louis Pasteur and others. We have also had the skill of hand washing pretty much since the beginning of civilised living and the

availability of clean water. In other words the possession of knowledge and skill in and of itself has **not** led to any change in our behaviour. To achieve change we need our knowledge and skills to have become routine habits of action.

There are, of course, plenty of reasons why health care workers might not wash their hands. They're busy. They see senior people not washing theirs. It's inconvenient. Hand washing equipment is not always in the right place. They forget. Despite the evidence not everyone really believes it matters. It's not regularly checked as everyone knows it's just on 'audit day'. Patients don't feel comfortable reminding health care professionals to wash their hands. We could go on. But the critically important learning here is that, in learning for improving quality at least as much time needs to be spent on understanding which habits matter and how they can be changed as on the knowledge and skills involved.

Martin Marshall, Peter Pronovost and Mary Dixon-Woods say something similar when they explore the nature of learning for improvement and also, interestingly, make a link to engineering science:

> *'Improvement science aims to create practical learning that can make a timely difference to patient care. It is characterised by its larger domain of interest, its applied nature, and its commitment to generation of practical learning that can be applied in real-life situations. Improvement science recognises and integrates many contributions; similar to the way that engineering science uses scientific knowledge and theories to address real-life problems.'*[13]

This kind of real-world learning is not unlike Aristotle's notion of φρόνησις (phronesis). Phronesis is a kind of practical wisdom and situational awareness – knowledge, skills and habits 'working together' in practice. Such phronesis is not achieved unless there is 'sensitivity to occasion' as David Perkins terms it.[24] That's to say it is only useful if when you are faced with a situation your mind and body routinely 'prompt' you to do whatever is the right thing to do.

So, entering a ward, a member of staff who has the habits of an improver pauses almost without thinking to wash his or her hands carefully, because the application of their knowledge and skill has become a habit.

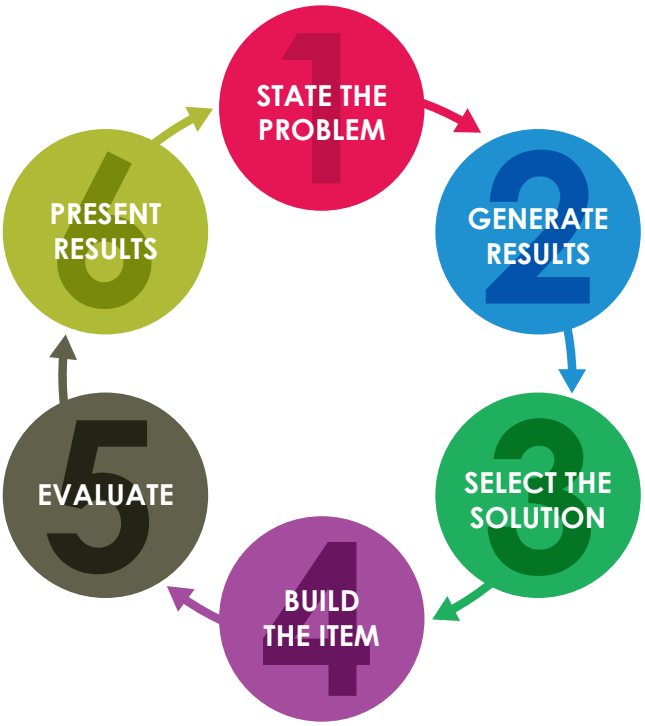
The inter-relatedness between knowledge, skills and habits as well as the interplay between cognitive and non-cognitive elements of learning has been a part of the discourse about professional competence in health for a while.[25]

Teaching and learning methods for improvement

Turning to our third and fourth questions about the characteristics of successful improvement work and the selection of the most effective methods let's reflect on the earlier example from engineering for a moment. Figure 4 (overleaf) shows a core learning method: the engineering design process.

Engineers move from problem to prototype to testing and back to a more refined understanding of the problem as they ply their profession. The engineering design process is central to the way they think and act.

Figure 4 – Engineering design process[26]



In all areas of improvement a core learning method which closely matches the iterative nature of making changes and evaluating these over time is the PDSA cycle (figure 5).

Figure 5 – PDSA cycle

Indeed the PDSA process is at the heart of the process of improvement. It requires thoughtful planning, execution, evaluation of tests of change over time and actions which are then, it is hoped, better than previous ones. And so on for many iterations.

There is an idea which is broader than a specific method that is potentially useful here – 'signature pedagogy'. First coined by Lee Shulman in 2005,[27] signature pedagogy refers to the types of teaching and learning which most suit or match the characteristics of a specific profession:

> *'Signature pedagogies make a difference. They form habits of the mind, habits of the heart and habits of the hand… signature pedagogies prefigure the cultures of professional work and provide the early socialization into the practices and values of a field. Whether in a lecture hall or a lab, in a design studio or a clinical setting, the way we teach will shape how professionals behave…'*

Perhaps the thinking that led to signature pedagogy could be applied not just to a profession such as engineering but also to the idea of improvement. If PDSA (like the engineering design process) is a specific signature method of improvement, the five habits of improvers – learning, influencing, resilience, creativity and systems thinking – might also suggest other specific methods, which, taken together, can create a pedagogy for improvement. Each individual method can then be underpinned by evidence of effectiveness.[*,28] Boxes 4 and 5, for example, describe two current approaches to teaching influencing as part of courses developing improvement capability.

Box 4: Developing the habit of influencing at Imperial College, London

As part of the Quality and Safety in Healthcare MSc at Imperial College, London, students learn about the habit of influencing in two different ways.

Using an actor to play the role of a patient or work colleague or relative, a scenario is created in which students have to empathise with another perspective, learn how to deal with feelings of conflict and develop and practise facilitation techniques they can use.

In parallel they explore aspects of current health policy and learn and practise ways of communicating these effectively to a range of different audiences using campaigns, speeches, social media and mainstream media.

Box 5: Developing the habit of influencing, Dundee

As part of the Quality Improvement, Cert, Dip, MSc at the University of Dundee, students study *Tribal leadership: leveraging natural groups to build a thriving organization* by David Logan as well as his TED talk on the topic. Students reflect on their own 'tribes' and discuss how different groups can influence motivation to engage in improving quality. Students focus on the importance of acknowledging which stage a tribe is at when engaging them in change, and try to identify what stage their teams/organisations are at and how they can engage them.

* For an overview of learning methods see Lucas B, Spencer E and Claxton G. *How to teach vocational education: a theory of vocational pedagogy.* London: City & Guilds, 2012.

From the same article from which we quoted at the beginning of this section, Molly Cooke and colleagues further characterise the signature learning methods of improving quality as:

> *'… pedagogies in which a) quality improvement is an integral part of all clinical encounters, b) health professions' students and their clinical teachers become co-learners working together to improve patient outcomes and systems of care, c) improvement work is envisioned as the interdependent collaboration of a set of professionals with different backgrounds and perspectives skilfully optimising their work processes for the benefit of patients, and d) assessment in health professions education focuses on not just individual performance but also how the care team's patients fared and how the systems of care were improved.'*[2]

Our own discussions with educators and experienced improvers have led us to add the following complementary and desirable elements into the mix of any signature pedagogy for improving quality:

- 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.

At the moment many different methods are used in the teaching of quality. The Health Foundation's evidence scan, *Quality improvement training for healthcare professionals,*[29] looked at more than 350 relevant articles published between 1980 and 2011 to establish what types of training about formal quality improvement techniques are available for health professionals. The evidence scan found a significant and growing number of training opportunities, broadly categorised as:

- classroom teaching
- distance learning
- practical projects
- ongoing training
- seminars and workshops
- simulation
- one-to-one training
- collaboratives
- ad hoc training during projects
- train the trainer approaches
- feedback for improvement.

Interestingly one term, leadership development, is missing from this list of categories. Its omission reminds us that finding a language to 'capture' learning for improvement in its broadest sense is often problematic. Nevertheless, if any system is going to change for the better we might expect to see leadership development included. In recent discussions about education

for improving quality, David Black, Medical Director of the Joint Royal Colleges of Physicians Training Board, argues that medical leadership is actually all about change: 'Clinical leadership is the ability to influence others to bring about better outcomes for patients.'[30]

We suggest that improving education for quality might be better understood and delivered if there is a greater consensus about its desired outcomes (the five suggested habits), more clarity about the signature pedagogies of improving quality, better matching of method to desired learning outcome and better use of evidence of effectiveness in selection of teaching and learning methods.

Bringing habits, skills and knowledge domains together

By framing discussions about improvement in terms of its desirable habits, we hope that educators are better able to design learning experiences and curricula that will develop the kinds of improvement capabilities needed by the NHS. We hope that our five habits might sit alongside the other considerations being explored by educators, such as:

a. What do learners already know and how do they already think and act?

b. What professional factors are important?

c. What is the context in which they are working?

d. What do they need to know?

e. What do they need to be able to do?

In terms of (a) the answer will vary depending whether we are considering initial or continuing development. With (b) whether you are talking about doctors, nurses, allied health professionals, managers and so forth will matter. With regard to (c) there will be many different contextual factors to consider. And the answers to (d) and (e) will be a blend of the generic and the specific, always shaped by context.

Nearly a decade ago Paul Batalden and Frank Davidoff articulated five different kinds of knowledge necessary for improving health care (see figure 6).

Figure 6 – Characteristics of five knowledge systems involved in improvement

Knowledge system	Illustrative features
1. Generalisable scientific evidence	Controls and limits context as a variable; tests hypotheses
2. Particular context awareness	Characterises the particular physical, social and cultural identity of local care settings (eg, their processes, habits and traditions)
3. Performance measurement	Assesses the effect of changes by using study methods that preserve time as a variable, use balanced measures (range of perspectives, dimensions), analyse for patterns
4. Plans for change	Describes the variety of methods available for connecting evidence to particular contexts
5. Execution of planned changes	Provides insight into the strategic, operational and human resource realities of particular settings (drivers) that will make changes happen
Source: Batalden and Davidoff, 2007[3]	

Recent thinking led by Batalden articulates the knowledge which might make up a curriculum of improvement science, outlined in Annex 2. Recently he has suggested ways in which thinking about knowledge systems and thinking about habits might be brought together in a matrix. This matrix would enable those developing curricula to map the different ways in which habits and knowledge and the skills which bring both to life might be explored in more detail (see figure 7). Figure 7 is illustrative only, taking the first three content areas from Annex 2 as exemplars, with a few examples of what could go into the matrix. As a tool we have found the process of cross-matching to be at least as useful as the specific suggestions and offer the tool in that spirit.

Figure 7 – Matching knowledge systems and improvers' habits[31]

	Learning. *Questioning, problem finding, reflective*	**Influencing.** *Empathic, facilitative, comfortable with conflict*	**Resilience.** *Optimistic, calculated risk taker, tolerant of uncertainty*	**Creativity.** *Team playing, critical thinking, idea generating*	**Systems thinking.** *Connection making, synthesising, accepting of change*
1.Beneficiaries of care				Exploration of approaches to co-production of care services, linked to a number of scenario-planning activities and role plays	
2. Health professional work as system, process	An introduction to action learning and the formation of action learning sets focusing on aspects of improving quality				
3. Organisations as complex systems.					Going beyond a simple understanding of the national and local policy infrastructure using approaches such as stakeholder mapping and driver diagrams to understand and explore different influence mechanisms

Approaches to education for improving quality are evolving considerably and in box 6 we offer two illustrations of this. The first, from the IHI's *Improvement Science in Action* course,[32] is a mix of conceptual and practical learning, focused on increasing individual and team effectiveness. The second, the Manchester Academic Health Science Centre *IS4Ac Curriculum* 2015[33] brings clinicians and academics together to learn about improvement science and provides support to teams to deliver targeted improvement projects over a 12-month period, using experts from across the world.

Box 6: Habits, skills and knowledge to improve quality – curriculum outlines

The IHI *Improvement Science in Action* course (2009) contains a mix of conceptual and practical learning including:

- Developing a *project charter* that clearly justifies and focuses the work
- Framing a challenging yet realistic *project aim*
- Understanding *organizational dynamics* of change and the *psychology of improvement work*, and use them to build an effective team
- Using *systems thinking, driver diagrams,* and *change concepts* to generate effective process changes
- Using *PDSA cycles* to identify promising ideas for change, then developing and refining the changes to achieve more reliable and effective processes
- Creating a comprehensive *measurement plan,* including operational definitions, data collection methods, reporting, and training
- Distinguishing between *common* and *special cause variation* to identify successful process changes and avoid common misinterpretations of the data
- Applying analytical tools, including *run charts, Pareto diagrams, scatterplots,* and *control charts* to analyze, interpret, and respond appropriatel y to data
- Understanding and applying important principles of *reliability science* to the design of processes.

Manchester Academic Health Science Centre's *IS4Ac Curriculum* (2015) explores:

- Quality improvement overview and historical perspective
- The model for improvement
- Developing an improvement charter
- The science of improvement
- Using Deming's system of profound knowledge
- Working with people using Myers-Briggs Type Indicator (MBTI)
- Analytic studies
- Factorial design
- SQUIRE guidelines
- PDSA cycles and change concepts
- Scaling up and implementing changes
- Tools for understanding variation
- Measuring for research and improvement
- Shewhart's theory of variation and Statistical Process Control
- Qualitative research
- Connecting qualitative and quantitative methodologies
- Large-scale change
- Social movement theory
- Publishing improvement work
- Innovation.

In both of the curriculum outlines provided in box 6, you can see the curriculum list-making tendency to which we referred earlier. Both draw on Deming and Shewhart, both talk of a charter (or justification) for improvement science. Manchester refers explicitly to the science of improvement, introduces some psychology and is more explicit about the social aspects of change involved. Both are relatively long lists of 'stuff', with no clear distinguishing between knowledge, skills and habits (although one can deduce some of these). Both were/are offered by highly credible organisations and undoubtedly have done or will do some good!

But had the five improvement habits (or an improved version of it) been available as a frame it might have usefully stimulated at least a discussion as to why one thing was deemed worthy of inclusion and something else not. It might also have encouraged debate about what improvers need to be able to **know**, what **skills** are important and what they need to be confidently disposed to **do** in a range of different contexts; their habits.

In the USA the Carnegie Foundation has usefully brought together thinking about habits, knowledge and understanding in its six principles for learning for improvement:[34]

1. Make the work problem-specific and user-centered.
It starts with a single question: 'What specifically is the problem we are trying to solve?' It enlivens a co-development orientation: engage key participants early and often.

2. Variation in performance is the core problem to address.
The critical issue is not what works, but rather what works, for whom and under what set of conditions. Aim to advance efficacy reliably at scale.

3. See the system that produces the current outcomes.
It is hard to improve what you do not fully understand. Go and see how local conditions shape work processes. Make your hypotheses for change public and clear.

4. We cannot improve at scale what we cannot measure.
Embed measures of key outcomes and processes to track if change is an improvement. We intervene in complex organizations. Anticipate unintended consequences and measure these too.

5. Anchor practice improvement in disciplined inquiry.
Engage rapid cycles of Plan, Do, Study, Act (PDSA) to learn fast, fail fast, and improve quickly. That failures may occur is not the problem; that we fail to learn from them is.

6. Accelerate improvements through networked communities.
Embrace the wisdom of crowds. We can accomplish more together than even the best of us can accomplish alone.

We think that these principles may also be helpful in thinking about learning for improvement in healthcare services alongside our habits approach.

5. Suggestions for action

> *'There are many barriers to developing a curriculum in improvement science, the greatest being lack of space in an already full curriculum. Others include the fear that basic sciences will be compromised, uncertainty of curricular content and lack of physician expertise in improvement science, and institutional culture. Improvement science involves working smarter, not harder – doing and improving one's work simultaneously.' (Samara Ginzburg)*[35]

Not everyone welcomes an emphasis on improving quality in health care or on improvement science as they inevitably bring thinking from knowledge domains with which clinical staff may not be comfortable. In the USA, for example, physician antipathy has been sharply delineated by Patricia Cuff and Neal Vanselow in their collection of essays exploring ways in which social science might be incorporated into medical curricula:

> *'Incorporation of the behavioural and social sciences into medical school curricula poses unique challenges to curriculum committees, especially when there is resistance from faculty and department chairs. Some faculty may be opposed because of a perception that the behavioural and social sciences are not 'hard' sciences and are therefore somewhat less important than other topics in the curriculum.'*[36]

But it would be quite unfair to suggest that it is just clinicians who are likely to be sceptical of improvement methods, especially as a growing number are also their greatest advocates. Indeed in the UK the Academy of Medical Royal Colleges currently has a Task and Finish Group seeking to provide strategic direction on all matters relating to improving quality for trainees and specifically, by the end of 2015, to propose options for improvement training for all doctors across all specialties, aligned and embedded with the efforts of the many partners with which they work. The 'Learning to Make a Difference' initiative of the Royal College of Physicians and Joint Royal Colleges of Physicians Training Board supported by the Health Foundation showed high levels of acceptability and feasibility in introducing improvement methods to medical trainees.[37] Similarly the Royal College of Nursing has a number of significant initiatives underway to embed such approaches into the training of nurses.[38]

Resistance to change in health care is hardly a new phenomenon and is widespread. Indeed the now defunct NHS Institute for Innovation and Improvement articulated the improver's *cri de coeur* well: 'It's so frustrating when you have a great idea for improvement – but your idea is met with opposition.'[39]

It went on to suggest strategies for managing resistance effectively, categorising three different kinds of resistance to be expected – opposition arising from lack of information, emotional reactions based on fear and a much more deeply entrenched opposition to change which is harder to fathom.

In a recent blog, Jennifer Dixon, Chief Executive of the Health Foundation, succinctly reminds us why the scaling up has been too patchy:

> *'One reason why there are pockets of improvement, rather than it being widespread, is that if you mention quality improvement – or QI – techniques to many clinicians, the response is often 'Q-what?' This is the result of no QI training or familiarity with the basic QI tools that, for example, Deming and Juran imported to health care from engineering half a century ago, and thus there is poor use of measures that might highlight the way ahead.'*[40]

Of course, while scaling up is important, determining the right things to scale up is even more so. As we have seen, it is easy to produce wish lists of improvement activities and methods, but much harder to get the right ones and embed them! Let us return to where we started out with our theory of change on page 9.

If we want to highlight the way forward and to make significant improvements, we need the majority of people working in the NHS to see improvement as part of their core role and have the confidence and capability to act on this. If we are to ensure that people receive the most effective education and learning for this, we need to be able to specify more precisely what aspects of improvement capability are needed for **everyone** working in the NHS.

Making use of the habits of improvers model

We offer the 'habits of improvers' model as a frame to all those currently developing curricula, introducing formal education and offering informal learning opportunities to develop improvement capability. We suggest it can be used as:

- a stimulus to debate about the desirable outcomes of learning for improvement
- a means of better deciding which topics and which pedagogies will be most effective
- a contribution to understanding the breadth of improvement and improvement science specifically at the level of desirable behaviours
- a way of better matching knowledge and skill domains to desired behaviours and habits in already overcrowded syllabuses
- an encouragement for better matching of specific teaching and learning methods to desired outcomes.

For those working in and with the NHS, both professionals and patients, we hope the thinking will:

- stimulate discussion and debate about improving care services
- act as a spur for debate about how people actually think and act when they are improving services
- provide a way of mapping current improvement capabilities within organisations, teams and individuals, identifying both strengths and weaknesses
- provide a frame for talking about improvement which goes beyond the boundaries of individual professional groups within the NHS
- suggest aspects of improvement which may be important for individuals and organisations as they plan their improvement work over time.

For fellowships and initiatives to develop quality improvement capability, such as the Q initiative, we hope our thinking might:

- offer a language for identifying, describing and sharing existing improvement practices
- help to map current and plan future development of improvement capability.

Annex 1: The idea of 'habits of mind'

This annex presents three approaches explored in *Thinking like an Engineer: implications for the education system*.[21]

Figure 8 – Mathematical habits of mind

Students who think like mathematicians should be:	
Pattern sniffers	Always on the lookout for patterns and the delight to be derived from finding hidden patterns and then using shortcuts arising from them in their daily lives
Experimenters	Performing experiments, playing with problems, performing thought experiments allied to a healthy scepticism for experimental results
Describers	Able to play the maths language game, for example, giving precise descriptions of the steps in a process, inventing notation, convincing others and writing out proofs, questions, opinions and more polished presentations
Tinkerers	Taking ideas apart and putting them back together again
Inventors	Always inventing things – rules for a game, algorithms for doing things, explanations of how things work, or axioms for a mathematical structure
Visualizers	Being able to visualize things that are inherently visual such as working out how many windows there are on the front of a house by imagining them, or using visualization to solve more theoretical tasks
Conjecturers	Making plausible conjectures, initially using data and increasingly using more experimental evidence
Guessers	Using guessing as a research strategy, starting with a possible solution to a problem and working backward to achieve the answer.
Adapted from Cuoco et al (1996)[41]	

Figure 9 – Scientific habits of mind

Open-mindedness	Being receptive to new ideas, prepared to consider the possibility that something is true and willing to change ideas in the light of evidence
Scepticism	Using critical questioning, adopting a critical appraisal approach, only according provisional status to claims until proved otherwise
Rationality	Appealing to good reason and logical arguments as well as a need to revise arguments in the light of evidence and argument
Objectivity	Adhering to accepted modes of inquiry in different disciplines and recognising the need to reduce the idiosyncratic contributions of the investigator to a minimum and always looking for peer scrutiny and replication of findings
Mistrust of arguments from authority	Treating arguments sceptically irrespective of the status of the originator
Suspension of belief	Not making immediate judgements if evidence is insufficient
Curiosity	Demonstrating a desire to learn, inquisitiveness and a passion for discovery
Adapted from Calik and Coll (2012)[42]	

Figure 10 – Building Learning Power

Resilience • Absorption • Managing distractions • Noticing • Perseverance	**Being ready, willing and able to lock on to learning** • Flow, the pleasure of being rapt in learning • Recognising and reducing distractions • Really sensing what's out there • Stickability; tolerating the feelings of learning
Resourcefulness • Questioning • Making links • Imagining • Reasoning • Capitalising	**Being ready, willing and able to learn in different ways** • Getting below the surface; playing with situations • Seeking coherence, relevance and meaning • Using the mind's eye as a learning theatre • Thinking rigorously and methodically • Making good use of resources
Reflectiveness • Planning • Revising • Distilling • Meta-learning	**Being ready, willing and able to become more strategic about learning** • Working learning out in advance • Monitoring and adapting along the way • Drawing out the lessons from experience • Understanding learning, and yourself as a learner
Reciprocity • Interdependence • Collaboration • Empathy and listening • Imitation	**Being ready, willing and able to learn alone and with others** • Balancing self-reliance and sociability • The skills of learning with others • Getting inside others' minds • Picking up others' habits and values
Adapted from Claxton, 2002[43]	

Annex 2: Knowledge, skills and dispositions to improve the quality, safety and value of health care services

This list of knowledge and skills which might make up a curriculum of improvement science has been put together by Paul Batalden with input from Bill Lucas and Improvement Science Fellows in UK and Sweden.

1. Beneficiaries of care. (Illness burden, co-production, minimally disruptive interventions, individuals and populations.)
2. Health professional work as system, process. (Professional formation, graphic depiction of work, interdependence, reflexivity, 'service' as input, 'logic' co-creating and co-producing.)
3. Organisations as complex systems. (Understanding, networking, facilitating knowledge and skill.)
4. Cooperation. (The nature of work, required behaviours when multiple professional disciplines work together with patients to co-produce services.)
5. Change. (Understanding, dealing with, designing, leading, leverage, spread of successful changes.)
6. Value creation. (Models, benefit/cost measurement.)
7. Framing as attraction leadership. (Sense-making, invitations worth considering, advocacy, execution, followership.)
8. Organisational theory. (Alignment with desired work, use by beneficiaries and professionals, value creation, sustaining good practices, culture, organisational learning, accountability.)
9. Situation and self-awareness. (Vigilance, context, opportunities, risks, requirements, constraints, personal reflection.)
10. Variation and measurement. (Analytic statistics, measurement fidelity.)
11. Social accountability. (Benefit, requirements, harm minimisation, promises.)
12. Testing, learning from tests. (Local change making, adaptation, reliability, resiliency.)
13. Designing. (Local change, adaptation, reliability, resiliency, 'service', co-creating/co-producing, ethnography, prototyping, simulation.)
14. Communicating verbally and in writing. (Presentations, peer-reviewed literature, writing and speaking clarity matched to a range of audiences.)
15. Social policy, regulation. (Political and economic process, social expectations.)
16. Evaluation, study designs. (Models, theories, limitations.)
17. Drivers, motivation. (Personal and organisational levels and the ways they exert influence in making/restraining change.)
18. Use of evidence. (Formulating uncertainty/question, ability to search, critically appraising, apply it to your situation.)
19. Power and authority. (Recognising, interpreting, influencing and addressing issues of authority gradients – including those between clinicians and patients, stakeholder analyses, influencing strategies, circles of influence and concern.)
20. Infrastructure and innovation, specifically requiring Informatics, Health IS and eHealth. (Able to think/frame a world too complex for the human brain, linking the expertise of engineers, ergonomists etc.)
21. Failure. (Defective processes, failure modes, unintended outcomes, resistance to change, mistakes, errors.)
22. Personal/professional embarrassment, reluctance to acknowledge desirability of improvement. (Fear, shame, denial, resistance to cooperate, interpersonal dysfunctionality.)
23. Planning. (Quality, Safety, Value planning, connections to strategic planning.)

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