

Recommendations For Innovation In Medical Education:
Opportunities For New Medical Schools.

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'Many thanks to all medical students and patients, past and present, whose experiences have contributed to this report. Also a big thank you to Professor Simon Mosey whose guidance has helped shape those experiences into a proposal I hope will bring positive change to the next generation of medical students and the patients they will treat.'

Kishan Rees, London, June 2018.

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Reflective Statement

This MBA dissertation considers the need for innovation within medical education, the challenges in doing so and the opportunities available to new medical schools who implement innovative approaches to medical education. The ideas contained in this dissertation are shaped by the wide and varied experiences I have had during my career to date. They are important to consider as such a non-linear career path is unusual for doctors, so have given me a broad range of insights. These roles have shaped my practise as a doctor and teacher as well as a disruptor who is interested in instigating systems change in order to improve the quality and safety of care patients receive on the widest possible scale. The common thread joining the various roles I have held throughout my career be they in clinical practice, education, management or media is related to my desire to improve patient care. A summary of roles I have held are listed below:-

- Specsavers Optical Advisor (2002-2008)
- Medical Student (2004-2009)
- Foundation Doctor (2009-2011)
- Core Surgical Trainee (2011-2013)
- Clinical Teaching Fellow (2013-2018)
- Medical Education Masters (2013-2015)
- Executive Masters in Business Administration (2015-2018)
- Emergency Medicine Middle Grade (Locum) (2015-Present)
- Health Pundit & newspaper reviewer - Sky News, BBC & LBC (2016-Present)
- NHS England Clinical Entrepreneur (2017-Present)
- Medical Affairs Manager at AstraZeneca (2018-Present)

Since I was young I have always wanted to be a doctor, but with no doctors in the family I was unaware of the intricacies of the medical profession. Subconsciously this desire to positively impact on people's health may have been as a result hearing about the medical care, or lack thereof, received by my maternal grandfather, Jamnadas Savjani, before I was born. As refugees fleeing Uganda, in the 1970s my mothers' family came to the UK in obviously challenging circumstances. When Jamnadas was tired and unable to work, despite being a successful and hardworking businessman in Uganda, he was told by his doctor he was 'lazy' and essentially needed to 'acclimatise to the British way of life'. My mother's family subscribed to the 'doctor knows best' narrative and wouldn't dare question the doctor, despite feeling something was awry. In that day it was completely unheard of for patients to question their doctor or seek a second opinion and medicine was practiced with a paternalistic approach. This interaction with the medical profession was devastating for my family. Jamnadas in fact had spinal tuberculosis; once that diagnosis was eventually made it meant the disease had progressed to such a state emergency spinal surgery was required. The delay in diagnosis made the surgery more difficult and complications meant Jamnadas was left in a persistive vegetative state and he sadly passed away. Growing up hearing these stories obviously influenced my view of the medical profession and at the time it was probably a fairly negative one.

I was fortunate to experience at first hand the positive impact of the medical profession, when I was hospitalised aged fourteen in 2000. I was treated for suspected viral encephalitis, after a holiday that was curtailed in India. I remember being incredibly ill yet also being fascinated with the cannula in my arm through which lifesaving intravenous medication was administered.

Experiencing at a young age when medical care goes wrong as well as the life-saving intervention of medical sciences as a patient were powerful formative experiences for an outsider. They provided

valuable reference points against which I could make judgements during the early part of my career and have shaped my view towards what is considered the 'art' of practising medicine.

Experiencing both the positive and negative aspects of the medical profession so early in my life also captured my attention. As a medical student I was determined to learn as much as possible, such that when I was practising medicine, I could contribute in a positive way to the health of my patients. Obviously also tempered by the negative experiences, I remain even more determined to institute positive and meaningful change within healthcare. Through my exposure to the medical profession in various roles including student, patient, doctor and teacher, I have come to appreciate how educational systems have been designed with a paternalistic approach, to the practise of medicine, in mind. Considering the rapidly changing healthcare environment these approaches no longer serve as appropriate preparation for future doctors. I hope this dissertation will help institute positive change within medical education, such that tomorrow's doctors are adequately equipped with the skills required to practise medicine in what is becoming an increasingly challenging healthcare environment.

My time working as an Optical Advisor at Specsavers was vital and proved to be an excellent foundation for my career as a doctor. This is the earliest example of being exposed to my preferred learning style, experiential learning. I also think this was significant as I learnt more about communicating with patients in a retail environment than I did in a classroom during the first two years medical school. On reflection these early years at medical school were somewhat of a missed opportunity. I believe this continues to be the case for many students in the early years of medical school. Looking at how this period of medical education is delivered and considering how it could be modified is a vital component for any new medical school wishing to maximise the opportunities provided to their medical students.

I can vividly remember sitting through lectures not really knowing how to learn and not absorbing information efficiently, whereas if I was shown or experienced something I would never forget. Part of this was rectified when I came to appreciate the differences between passive superficial and deep active learning, but that was only when reading for a Medical Education masters, four years after graduating from medical school. Having taught medical students since 2013 it is certainly my experience that the majority are unaware of their learning styles, so curriculum time invested in this would be beneficial for all students.

Another aspect, accounting for why I struggled with certain forms of delivery, was my undiagnosed dyslexia which was discovered in April 2017. This journey has caused me to reflect on my learning style, which has shaped the way I teach and made me consider ways medical education could be improved for all students.

The environment within medical education is changing. With the introduction and increase of tuition fees some students are approaching their studies with a consumeristic mentality. The reputational risk that can be leveraged on institutions via student feedback is immense. Students are aware of this as are higher education institutions, so a significant emphasis is placed on student feedback, which can make the implementation of active learning methodology challenging at times. I believe we are witnessing a seminal time in higher education. More specifically with the advent of five new medical schools this represents a unique opportunity to influence healthcare in the UK in the long term. New medical schools have the potential to provide the impetus to revolutionise the learning of a generation of doctors and the positive contribution that could be made to the NHS in terms of widespread cultural change is immense.

This report will detail the potential for innovation within medical education. Also of great importance is taking an individualised approach to medical education for each student and integrating patients throughout the whole medical education process. The competitive environment is such that those medical schools that successfully introduce innovation will prosper and could shape medical education on a wider scale initially nationally and then potentially even internationally.

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Abstract - New Medical Schools & A Once In A Generation Opportunity

Over the last fifty years the rate of advance within medicine has been quite remarkable (Le Fanu, 1999).

With this healthcare has become increasingly complex (Rouse and Serban, 2014) and the associated risk to patients when things go wrong has also increased (Makary and Daniel, 2016). There is an interesting dichotomy in that by and large the process of medical education has remained largely unaltered for the past century (Flexner, 2002). Medicine is an inherently conservative profession based on a hierarchical structure, so when left up to the profession to introduce innovation within medical education such change has not been forthcoming.

Given the current climate within both the NHS and higher education institutions, which will be explored throughout this dissertation, a situation has arisen where medical students and patients have an increasingly powerful voice. Medical students generally are not happy and don't feel prepared for life working as a doctors, as evidenced by The National Student Survey (NSS). When they graduate and start working in what is a difficult NHS environment the situation is compounded by the fact they are not appropriately skilled to complete certain tasks. This may lead to issues with the care patients receive. When this is coupled with an increasingly pressurised working environment and patients being encouraged to publicly rate their doctors online it creates a challenging environment for doctors to work in.

This report will consider how the medical education process can be refined to better suit the needs of medical students going through the system, with the intention of maximising their time spent in medical school, in order to equip them with the skills, knowledge, attitudes and approach to learning that will help them prosper as doctors and integrate within multidisciplinary teams such that excellent patient care can be provided. With the formation of five new medical schools, this represents a unique

opportunity to shape medical education in a way that leads to improvements in patient safety and quality of care in the longer term. In order to maximise this opportunity a co-ordinated approach where best practice is shared between the new medical schools would be beneficial. It is important for a collegiate approach to be fostered between the new medical schools rather than a culture of competition, hence the major recommendation of this report being the formation of a Medical Education Shared Innovation Network (MEDSIN) administered by Health Education England (HEE).

This report looks to maximise and spread that benefit, initially nationally and eventually internationally, by providing a blueprint for implementing innovative approaches to medical education. This is a blueprint which puts patients at the heart of the medical education process and equips students with the skills, attitudes and an approach to learning that serves as the foundation to the rest of their career. This is somewhat of a departure from the traditional didactic paternalistic approach to medical education. There is definitely a changing dynamic between the public and the medical profession. The rise of expert patients and their access to medical knowledge coupled with patients also generating their own health data means medical education must evolve if we are to equip medical students with the skills required for their future careers. This dissertation proposes the way to facilitate that evolution is via introducing improvements via the incorporation of innovative approaches to medical education from the beginning of students' education in new medical schools.

Introduction

The National Health Service (NHS) has grown, since its launch in 1948, to become the world's largest publicly funded health service. With 1.3 million employees, the NHS is an incredibly complex organisation and the process of implementing widespread cultural change can take many years. After the initial furore over a scandal has subsided the impetus for instituting meaningful change seems to dissipate. This has been demonstrated by failings to implement the recommendations from public inquiries into NHS scandals such as The Kennedy and Francis Reports, into Bristol and Mid Staffs respectively (Kennedy, 2001, Francis, 2013).

The NHS serves a population which is living longer with an increasing number of complex medical needs (George et al., 2006). This means doctors must deal with how that interplay of diseases affects their patients. The basic formula of medical education in the UK has remained largely unaltered for decades. Considering the complex interplay of diseases and the rapidly changing external environment in healthcare it is perhaps unsurprising the current models of medical education leave students feeling underprepared and dissatisfied. Overleaf there are several factors within the external environment which make a change within the medical education process a necessity. Organisational change can be difficult to achieve within existing universities (Clark, 1998). This is what gives new medical schools the competitive advantage (Porter et al., 1996) in terms of implementing such an innovative approach. Through arranging curricula and teaching to take into account the factors detailed overleaf, medical schools will be equipping their future graduates with the skills required to not only survive but thrive within what is a challenging NHS environment.

Factors within the external environment which increase the need for innovation within medical education include:-

- A drive towards making medicine more patient centred and consultations being a conversation between healthcare professionals and patients who are increasingly well informed,
- Public ratings and reviews of doctors and the care they deliver, by patients on the website www.iwantgreatcare.org,
- Increased availability of knowledge, placing a significantly altered emphasis on the doctor-patient dynamic. This is something particularly relevant to medical students, as current medical education processes have not altered to take this new situation into account,
- Patients collating, compiling and controlling their own health data, analysing it in relation to their life and deciding which healthcare professionals to share it with,
- Delivery of healthcare increasingly by highly specialised multi-disciplinary teams,
- Medical students having an increasingly powerful voice via the NSS, a yearly survey delivered by Ipsos MORI on behalf of the UK Education funding bodies, which rates several aspects of university courses from students' perspectives,
- The General Medical Council's Medical Licensing Assessment (MLA) which is on the horizon and currently due to be implemented in 2022.

These factors are vitally important to consider as the extent to which teaching and training prepares medical undergraduates for what faces them when they start work, is increasingly being used as a metric to measure performance of medical schools. For the first time in many years the NSS and the increasingly commercialised culture in higher education, with the introduction of significant tuition fees, means universities must look at the issue of how its course is perceived to prepare graduates for working life. This has resulted in a drive within existing medical schools to change their courses, making

them more clinically relevant and patient focussed. The difficulty these established organisations face is implementing curriculum change in a timely manner, thus providing a unique opportunity for new medical schools to differentiate themselves from the competition. Whilst also circumventing the well documented difficulties existing medical schools have in adapting their courses so that they are focussed on preparing their students for life as foundation doctors.

Delivering Medical Education Within The NHS

Changes to NHS working practises and environments have had a significant impact on the experiences of undergraduate medical students. With the implementation of the European Working Time Directive (EWTD) we have seen the loss of a firm based structure, which involved a team consisting of a consultant, registrars and junior doctors working together and responsible for the care of the firm's patients spread across multiple wards, for the duration of their hospital admission. This has been replaced with a move towards ward-based teams and shift working. This change has led to a loss of continuity of care and the removal of the apprenticeship aspect of medical training. Were such a system still to be in place, it is the author's opinion, some deficiencies within undergraduate medical education could be compensated for as there is the opportunity for them to be rectified through close supervision within the firm in the early stages of training post qualification, for example becoming competent with clinical skills. Due to the way the system is set up junior doctors are more likely to be involved with administrative tasks rather than honing their clinical skills under direct supervision.

Undergraduate medical education, and to a certain extent post-graduate training, has not adapted to take into account the loss of supervision associated with a firm structure. Couple this with how juniors are now only responsible for snapshots of patients' care when they are admitted on their ward - it makes for a very difficult learning environment. Shift working essentially places newly qualified foundation doctors in a fairly exposed position where their deficiencies can be highlighted. With

foundation doctors trying to learn their trade and being isolated, it is unreasonable to expect them to teach and train medical students. This also has the knock on effect of leaving medical students marginalised and shielded from experiencing the harsh realities of practising medicine as a junior doctor. As a result they often feel unprepared for when they graduate. A problem amplified by the loss of the 'firm' structure and the failure to compensate for this loss within existing medical education processes.

It is unlikely firm based working will be re-introduced, as despite the educational advantages, it did mean doctors were working long and sometimes dangerous hours with significant implications for patient safety (Gaba and Howard, 2002). Medical education practises have not evolved to equip students for the challenges they face as newly qualified doctors, this is a potential risk to patient safety and another driver for instituting change within medical education.

The current climate within the NHS means medical students encounter many difficulties in clinical environments for a multitude of reasons. The traditional split between pre-clinical and clinical phases has long been criticised for not adequately preparing students with the clinical knowledge required for working in such an environment (Prince et al., 2005). Current service pressures are so high it means medical students are often left as passive observers, as they are unprepared for working in such environments with staff unable to supervise. Each time this happens it is a wasted learning opportunity and, understandably, medical students become frustrated.

The External Environment & UK Medical Education

There are thirty-two medical schools in the United Kingdom that are recognised by the General Medical Council (GMC) from which students can obtain a medical degree. Although a GMC administered national licensing exam due to be implemented in 2022, known as the Medical Licensing Assessment¹ (MLA), this is something that has been proposed for many years (Wass, 2005) and highlights the slow pace of change within medical education. It is worth noting there are currently still wide variations, in course structure and curriculum, between the various medical schools. Some are scrambling to alter their courses to make them increasingly patient based with more clinical exposure, while others are hanging fire re-organising curricula given the impending introduction of the MLA. Consideration of the MLA really is vital for medical schools implementing new curricula as this will future proof them to some extent. Ultimately equipping students with a flexible approach to learning and encouraging them to be inquisitive experiential, rather than strategic exam focussed, learners will stand them in good stead for their career working as a doctor. The challenge within medical education revolves around equipping doctors with the skills needed to contribute as part of multi-disciplinary teams delivering excellent quality care. When for large periods of their undergraduate education they are away from such teams and have limited exposure to patients.

1 <https://www.gmc-uk.org/education/29000.asp> [Accessed 19 Dec 2017]

The relationship with the NHS is further complicated by many schools still having differing pre-clinical and clinical phases to their courses. This means students could spend between two to three years at medical school with minimal patient contact. Evidence within the medical education literature suggests a lack of early patient contact complicates the medical education process and makes it harder for medical undergraduates to assimilate knowledge according to constructivist educational principles (Pressley et al., 1992).

Medicine, as a profession, is inherently conservative and cautious regarding change. There are also difficulties instigating change within an organisation as large as the NHS, as evidenced by the difficulties encountered in applying the recommendations from 'Learning from Bristol' Sir Ian Kennedy's report into Cardiac Surgery at the Bristol Royal Infirmary (Kennedy, 2001). This is relevant as the report concluded there were several lessons applicable to the NHS as a whole rather than specifically related to Bristol. Given failings were repeated with the Mid Staffs Scandal, some two decades later, this dissertation argues the importance of seeking to implement cultural change within the organisation via a long term approach involving innovation in medical education, targeting medical students at the start of their careers rather than trying to implement top down organisational change.

The Drivers For Change

The process of training a doctor in the UK to full GMC registration costs in excess of £250,000 with some estimates putting the cost as high as £400,000 (Meducation, 2017). Medical students are responsible for an increasing proportion of that debt paying £9,000 per year tuition fees and they can graduate with more than £80,000 of debt (Meducation, 2017). With increasing numbers of doctors dropping out of the medical profession, as evidenced in the GMC's 2017 annual report titled 'The State of Medical Education and Practice in the UK', there is a concern over the tax-payer obtaining value for money. This has led to a current consultation where the Department of Health (DoH) is considering what should be an appropriate number of years newly graduating doctors would be committed to working for the NHS. The same GMC report also states the medical profession is in a state of unease and the levels of burnout and depression among doctors is at an all-time high. The concerns regarding quality of care, by forcing these doctors to stay working in the system, are clear considering the situation that arose in Mid Staffs where a culture of poor care became accepted as 'normal' by staff worked to the point of burnout.

Students changing relationship with higher education providers is a vital new driver for change, which makes these problems especially relevant for universities with medical schools. Students are now becoming significantly financially invested in the process and they demand adequate preparation for the NHS environment that faces them as newly graduating doctors. Students have an increasingly powerful voice through the NSS which has a direct effect on applications from new students and therefore funding associated with student numbers. The potential for reputational risk to be leveraged on universities is immense and illustrates a powerful driver for change, given interest from Vice Chancellors and Deans across the country in terms of preventing this. It has made medical schools keen to ensure their courses and curricula are adequately preparing future graduates for the working environment that awaits them.

Scope Of Report

This document proposes an innovative approach to medical education, which places patients at the centre of the process, seeking to improve the degree to which medical education prepares students for learning and then working within the NHS. It also reflects a change within the medical profession, a move towards patient centred care, which has not been mirrored widely within the undergraduate medical education process. The proposal has been written with a focus on the University of Lincoln as they were successful in their bid to get a Medical School, but is equally applicable to any of the five new medical schools in England announced by The Department for Health and Social Care in March 2018.

The formation of a new medical school represents a unique opportunity to innovate and improve the training given to future doctors, without having to overcome the numerous hurdles associated with implementing cultural change in an existing organisation as alluded to by (Scott et al., 2003) and (Hall and Hord, 2006). Such an approach offers a potential long term solution to dealing with the many challenges faced by the NHS. To gain an appreciation of what educational experience students are coming to higher education with is vital. Part 1 considers the current educational landscape and how it impacts on medical education. Part 2 looks into the traditional philosophy of medical education and how it has influenced current practise. Part 3 considers the traditional pedagogy of medical education and what problems there are with this approach.

We are currently in a unique situation within higher education with the introduction of tuition fees and the increasing prominence of the NSS, this is explored in Part 4 where consideration is given as to how the student's changing relationship with higher education can be harnessed to alter the philosophy of medical education.

A similar situation, where a new medical school coincided with a time of cultural change, arose in 1974 and the opportunity was seized upon by Maastricht University. They introduced an innovative approach adopting Problem Based Learning (PBL) which has since become firmly established within its approach to medical education, as such lessons from Maastricht will be considered in Part 5. Finally, Part 6 will propose how innovative approaches may be introduced within a UK medical education context.

Key Stakeholders

The Universities Of Lincoln & Nottingham

On the 23rd of November 2017 The University of Lincoln (UoL) and The University of Nottingham (UoN) submitted a joint bid for a new medical school. UoL has aspirations for its own independent medical school in the future and UoN are likely to want to keep the Lincoln school as a satellite site much in the same way it has an arrangement with Derby. UoL and UoN are very different organisations with varying approaches. UoN is an established Russell Group University, whereas UoL is a relatively new organisation that is incredibly responsive to the needs of their students something reflected in their excellent NSS results. UoN have struggled to respond to the needs of their students and have suffered with significantly worse NSS feedback. The likelihood of competing agendas and approaches to this project in the long term is high and as a result there is a risk innovative approaches to medical education may be stifled at a significant cost to UoL. This is a situation likely to be replicated whenever two large organisations embark on a joint venture. A common requirement for all new medical schools is a philosophy towards education. This is especially important for UoL given they are going into partnership with an existing medical school and are keen to have their own identity moving forward.

This report will review the process of medical education and identify where innovative approaches could be employed. This document has been written to provide UoL with an identity and learning philosophy towards medical education, such that it can develop its own medical school but also be in a position to export best practice. The recommendations in this report could be applied to any medical school new or old, but potential for successful implementation is higher in new medical schools as, inter alia, there will be less resistance to change from staff used to using tried and tested educational techniques.

As UoL will be going in to partnership with UoN initially, that provides approximately 20% of the curriculum that can be modified. This represents a great opportunity as the pre-existing 80% of the curriculum provides security in terms of passing the GMC quality inspection. This report seeks to identify ways the 20% can be used to introduce elements of innovation into medical education which positively influences students approach to their studies and how they will practice medicine in their future careers. Should this approach to innovating within and reforming medical education, making it more patient centred, be successful there is the potential for other medical schools to look at UoL for best practice in the future. Despite this being a longer term objective it is essential these matters are considered in the early stages of planning the new medical school's curriculum. Successfully innovating within medical education will provide UoL a key differentiator in what is an increasingly competitive higher education environment for medical schools. Not only do they need to compete with established medical schools but also private medical schools, such as Buckingham University, offering additional management modules and qualifications.

United Lincolnshire Hospitals NHS Trust

United Lincolnshire Hospitals Trust (ULHT) faces several challenges when recruiting medical professionals. This is not uncommon for many hospitals in the East Midlands; however such issues are exacerbated by ULHT's geographical location within the Deanery. There are many rota gaps and ULHT has spent significant sums of money for locum staff to fill these gaps. With the introduction of IR35 tax regulations in 2017, which makes it less lucrative for doctors to work additional shifts, the problem will still remain with regards to appropriate staffing. This is important to consider when it comes to providing appropriate support for medical students in clinical environments.

ULHT was recently placed in special measures by the Care Quality Commission (CQC). It is well known that failing organisations education and training budgets often face cuts. There is a recruitment and retention crisis across the country, but the situation is particularly exacerbated at ULHT because of its geographical location and is compounded by the lack of a medical school in the area. The new medical school will add prestige and could become a powerful influencing factor in improving culture and standards of care.

Given UoL has been granted a medical school, partnering with ULHT, it would be beneficial for both parties as well as the local community. In the short term changing the culture to one that embraces educational excellence would be a positive contribution that could be made by introducing appropriately prepared medical students into the system and incorporating them as part of the multidisciplinary team. In the longer term there are benefits to the hospital, as medical students may want to stay in the area and contribute to making continual improvements to local health services.

There are no quick solutions to the issues ULHT faces, and in many cases they are mirrored across the whole of the NHS. An innovative approach to education coupled with a long term strategic partnership between the UoL and ULHT may well provide a template for improving issues within the NHS across the country.

Health Education England

Health Education England (HEE) are an important stakeholder as they have the national infrastructure to set up and administer a network to foster the spread of innovation between new medical schools. There is also the potential for other organisations, such as The Royal Society of Medicine, to be involved in shaping this change.

Part 1: How Does The UK School System Impact Upon Medical Education?

Pre Medical School Education

To look at making changes within medical education without considering the educational environment from which students attend would make the process of successfully implementing such change complicated and prone to failure. Thus before considering the current philosophy of medical education, the current approach within the UK's educational system is looked at to give a valuable insight as to the position first year undergraduates are starting from. Understanding how their behaviours and approaches to education have been shaped will be useful for guiding implementation of innovative approaches within higher education.

There is a growing feeling today that there is something wrong with our education system and the extent to which it prepares students for life in the real world. It is important to note that while the real world is changing at incredible pace, our schools haven't changed much for hundreds of years. There is an interesting parallel here with medical education in regards to the rate and pace of change combined with a conservative approach towards implementing innovation in education.

Several thought leaders (Godin, 2010, Robinson, 2010) are of the opinion that the current system of schooling was designed in order to prepare people during the Industrial Revolution for working in factories and an 'Industrial Age' philosophy of mass production and mass control still resides deeply within our educational establishments today. In the author's opinion this certainly dampens individualised approaches associated with encouraging entrepreneurship and creativity.

Industrial Age Values & A Homogenous Approach To Education

Children are educated in batches meaning individualised approaches to learning are often overlooked.

In addition all day long children just follow instructions. While this approach may be useful for producing factory workers, required during the Industrial Revolution (Mitch, 1999), these values do not equate to success in real world environments, which are becoming increasingly entrepreneurial (Collins and Halverson, 2009). In entrepreneurial environments people who are creative, collaborative and capable of communicating their ideas are highly valued (Bilán et al., 2005). These are skills vitally important to doctors practising medicine, but are almost conditioned out of students by the time they arrive at medical school. A batch mentality to education remains also prevalent in medical education and medical students are once again denied the opportunity to develop these skills. Medical students are insightful that the current system is not preparing them for life as a doctor and is a source of great concern amongst the student body.

Lack Of Autonomy & Control

In the current UK school system every minute of a child's life is regulated by the system, again while beneficial for a factory, this does not reflect the requirement of having to manage one's own time and making decisions about what to do where and when. Certainly from the author's experience the majority of students prefer heavily timetabled and structured placements. Sadly this is at odds with the working environment they will be entering which at times lacks structure. We would be better off equipping students with the skills to identify learning opportunities in an opportunistic manner and then rewarding them with examinations that allow them to demonstrate the knowledge, skills and experience gained. As Dickinson eludes to, having autonomy over ones learning is vitally important (Dickinson, 1995) and can lead to improved outcomes. While the educational system feeding into medical schools does not encourage students to take an autonomous approach to learning, introducing elements of autonomy into an innovative medical school curriculum can only be a good thing in terms of

encouraging clinical students to attend the wards and identify learning opportunities. This is of course dependent on a revamped approach in the pre-clinical years equipping students with the appropriate foundations to develop such skills.

Inauthentic Learning

Most of the learning that occurs in both schools and medical schools today is not authentic as it relies on memorisation and rote learning (Brown et al., 1989). Given the advances being made in medicine this is problematic as it is impossible to memorise the entirety of medical knowledge. Of far more value to medical students would be spending time where, having gained the basic foundations, they are developing analytical skills and then collaborating with members of multi-disciplinary teams and finally communicating those clinical decisions to patients in a concordant manner.

Current educational systems define a generic set of knowledge that all students must know. Then every few months tests and exams are administered and what has been retained is checked. There is of course a basic level of knowledge required by medical students in the early phase of their courses, but such an approach persists throughout their undergraduate and postgraduate careers, by which point elements of what they have learnt has become obsolete. Such an approach to assessment is also problematic as it encourages a superficial strategic approach to learning, much of which is forgotten shortly after the examination. Innovative approaches to medical education have the potential to improve this situation.

Standardised Approach To Learning

The same material being delivered in the same way to cohorts of students, which does not allow for an individualised approach to learning, means opportunities to identify talent can be missed. This is probably also true for medical schools in that students are treated as a homogenous group.

Differences In How We Learn

Pashler et al discuss how there can be vast differences in how students learn as there can be significant differences in how information is processed and assimilated (Pashler et al., 2008). Different learning styles will require varying amounts of time and learning resources. Educational systems generally have no capacity to deal with such differences, so if students are a bit slow in learning something via the conventional means they are deemed a failure. We are however starting to see a changing culture where students demand learning environments tailored to their needs. This can introduce conflict into the 'student-teacher-university' dynamic given current medical education methods are rather homogenous. Styles such as experiential learning (Kolb and Kolb, 2005) may be challenging to provide in higher education let alone to junior medical students in a healthcare setting. There is however evidence to suggest this is beneficial to provide (Kolb, 2014, Maudsley and Strivens, 2000). This is where innovative approaches to education can help maximise the time spent by students in medical school. Spencer et al wrote about the importance of learner centred approaches to medical education (Spencer and Jordan, 1999), yet despite this being almost two decades ago the practise is still not widespread and is by no means routine.

Summary

Our current educational system evolved during the Industrial Revolution and while it equipped people with skills and attributes relevant to the time, it is probably counterproductive for what is required in today's information rich, entrepreneurial world. This has particularly important connotations for medical education and medical professional's relationship with members of the public. Far more emphasis should be placed on the development of generic transferable skills and the ability to be creative, collaborative and above all communicate decisions with patients and then come to a shared understanding. In a world where healthcare is becoming digitised and pills are available with microchips to say when they have been taken appropriately, there will be an increased importance placed on doctor's communication skills often referred to as 'soft skills'. Medical schools wishing to innovate would need to look at incorporating these kinds of skills as an integral part of their training.

Part 2: What Is The Traditional Philosophy Of Medical Education & How Has It Influenced Current Practise?

The Flexner Report

Many elements of the medical education process in the western world can be attributed to The Flexner Report (Flexner, 2002). Published in 1910, it called on American medical schools to adhere strictly to the protocols of mainstream science in their teaching and research and led to the successful standardisation of the medical education process (Beck, 2004). This report was a seminal document as it succeeded in creating a single model of medical education, which involved a foundation in biomedical sciences including human anatomy, physiology and biochemistry that have largely survived to the present day. With this in mind future reform may be met with resistance. Given there are several external factors driving this change, universities that do not change will be left behind. A wave of innovation has recently swept throughout the American medical education system (Beck, 2016) and it would not be unreasonable to expect similar changes occurring in the UK.

Basic Medical Sciences

The importance of giving students a foundation in the basic medical sciences is not in question. The way in which this education is delivered is however an important area for discussion. Firstly, it would be preferable if basic medical science content that was delivered had a clinical context, this can be difficult to achieve without input from clinicians, so it's important to foster these links. Secondly, it has been highlighted (Centor, 2015) within medical education there is often a failure to deliver foundation must know 'core concepts' within the various medical science disciplines including anatomy, physiology, biochemistry, pharmacology, histology and microbiology. What commonly occurs is basic as well as advanced concepts are taught as one package. This means it can be difficult for students to grasp key concepts let alone how they are clinically relevant and applicable to their patients.

Are We Educating Doctors For A Bygone Era?

Flexner's report sought to shape medical education so that it produced clinicians who are 'autonomous, independent and authoritative'. These are attributes that were required for doctors of a different era. Not only would clinicians operate within their own self-contained sphere of practice they were also the sole purveyors of medical knowledge. Given members of the public had no access to medical knowledge other than through their physicians, it led to a significant power differential in the doctor-patient relationship. This led to concepts such as 'patient compliance', 'doctor's orders' and 'doctor knows best' being deemed appropriate. Although it is generally accepted in practice these are not appropriate ways to approach interactions with patients, much of the teaching and assessment methodology used in medical education today have roots from this era. It definitely means there is great potential to innovate within medical education, making it more patient centred, and reflective of the healthcare environment of 2018 and beyond.

See One, Do One, Teach One

'See one, do one, teach one' is perhaps the most damaging approach that has been used within medical education. The implication of this phrase, which has remained prominent within medical education culture, is that doctors only need to see a procedure once, perhaps not even in an educational environment, before they are able to complete the procedure unsupervised and then teach someone else. Thankfully this approach is dying out, as the inherent risks to patient safety are clear to see. However, it can be tempting to resort back to such an approach when there are such severe service pressures. One of the major challenges within medical education is countering the legacy left behind from this approach.

Medical education is steeped in history and tradition. Protocols such as always standing on the patient's right hand side and kneeling down when examining their abdomen in finals examinations are very much seen as part of the professionalisation process and a rite of passage into becoming a doctor. As such the teaching and training in preparation for these exams shape the attitudes, beliefs and behaviours of those who enter the medical profession. While such an approach suited the acute disease era of the 20th century, it is an approach which is not conducive to producing the doctors required for the chronic and complex disease era of the 21st century, where patients generally have an increased understanding of their condition and how it affects them. Patients are also not afraid to challenge doctors. Changes in medical education are needed in order to reflect this very different dynamic.

The Traditional Nature Of Medical School Exams

Traditionally the examination environment within medical education has been one where doctors and patients have been on very unequal footings. It is widely accepted assessment drives learning (Wood, 2009). So is it any surprise the way we train medical students to behave in exams has an impact on how they behave when they become practicing clinicians? For too long medical examinations have basically been cases of the student putting on a performance for the examiner. Patients are expected to sit there as the examination would be stopped and started by the examiners and the student would then immediately turn to the examiner and start talking about the patient. The author has always found this situation odd as it flies in the face of training caring and compassionate doctors if behaviour like this is considered acceptable and rewarded in examinations. Such an approach may have been deemed appropriate when doctors were the gate keepers to medical knowledge but is totally out of date now. Remnants of this approach still remain within medical school finals examinations today. Large aspects of both current curricula and examinations do not represent the changing medical environment and its associated challenges.

Killing Season

It is a well-recognised phenomenon that every August when new medical students graduate and existing doctors all become a grade more senior overnight there is an increase in mortality within UK hospitals (Aylin and Majeed, 1994). This period has been colloquially referred to as 'killing season'. If you speak to final year medical students, on their shadowing period, the majority of them feel woefully underprepared for the start of their job which is somewhat of a baptism of fire. This is despite medical students having spent five to six years in medical school. There are various factors behind why medical school does not reflect what life is like working as a doctor. An innovative approach to tackling these issues is a long term solution, only possible through reform of medical education curricula which fosters closer links between the clinical environments in which students are placed and the medical school. With such linkages in place it should provide more opportunity for students to safely shadow and identify learning opportunities on shifts. These can then be reflected on at a later date with teachers. At the moment students do not experience night shifts. Surely it cannot be right to expect newly qualified doctors to cope having never done night shifts as a student. The phenomenon of 'killing season' is a complex concept and to blame it entirely on failures within medical education would be unfair. However, modifying medical education at a grassroots level has the potential to have a positive influence on this phenomenon in the years to come.

A Problem Retaining Doctors

According to the GMC's 2017 'State of Medical Education' report junior doctors are leaving the profession in record numbers. In 2012, 77.7% of doctors were taking up further training post Foundation Programme completion. Three years later by 2015, this had dropped to 65.7%. This equates to a reduction of 582 doctors choosing not to continue their training after working just two years as a doctor. The most recent figures show just 43% of Foundation Year Two doctors progress straight to speciality training (Torjesen, 2018). The reasons behind this are multifactorial but adequately training these doctors during their time as a student is vital, both so they can cope and so the taxpayer gets a return on investment for the cost of their training. The government is currently undertaking a consultation where doctors would be required to work for the NHS for a period of between two and five years, in an attempt to get an adequate return of investment. Should this become legislation we owe it to doctors, as well as patients, they are equipped with the skills required to be able to function well within the NHS and provide a high standard of care.

Resilience Training

Much has been made of the need for resilience training; this however cannot be an afterthought as is commonly the case. The only way medical students can be helped to acclimatise to the harsh NHS environment involves maximising every learning interaction with patients, such that activities like simulation and shadowing provide opportunities for them to gain the skills they need to prosper in the NHS as doctors. This may well lead to higher retention rates, but such training needs to be embedded throughout the course structure at new medical schools, to reap that benefit.

The State Of UK Medical Education & Practice

The GMC commissions an annual report into the state of medical education and practice in the UK. This comprehensive report, which collates information from national surveys as well as their findings from their activities in the quality assurance of basic medical education, is used by Deans across the country to identify upcoming trends and challenges in medical education. In the 2013 report the first signs of financial pressures, since 2009, were starting to make their mark on front line services for patients. 2013 also saw the publication of The Francis Report which looked into failings in the Mid Staffordshire NHS Trust. This report concluded an environment existed where care, compassion and leadership were lacking. Frontline clinicians had become disengaged and accepting of poor standards. These factors all conspire to create a 'bad practice arena'. It is vital educators are mindful of this, acknowledging the difficult environment within the NHS while also equipping students with the skills required to not only survive but prosper in such settings.

The GMC's 2013 report also talks of a 'toxic culture' where doctors are blaming politicians and managers for what they saw as a loss of medical autonomy and a misplaced focus on targets and money. This situation was compounded by unwillingness amongst elements of the profession to embrace organisational goals. Antagonistic relationships and a culture of disengagement are two factors reported which posed a risk to patient care. When there is a hostile environment between clinicians and managers it is a great challenge to integrate impressionable medical students into that organisational culture such that they are left with a positive impression and inevitably their educational experience suffers. However, taking an innovative patient centred approach to medical education there is the potential to demonstrate to medical students the positive impact they can have on patient care while working in such a challenging environment.

The 2016 GMC report into the state of medical education summarises the situation under the strap-line 'A profession not at ease'. This is incredibly concerning as the report states pressures are having a direct impact on the education and training environment within NHS hospitals. The innovative patient centred approaches to medical education, contained within this report, seek to equip medical students with the skills and resilience needed to learn medicine within such a challenging environment. The aspiration is once these students have qualified they can be 'agents of change' and positively impact patient care on the front line.

Is The NHS A Learning Organisation?

The cases involving heart surgery at the Bristol Royal Infirmary and the failings of care at the Mid Staffordshire NHS Trust are two of the biggest scandals to affect UK healthcare. The public inquiries into these events, the Kennedy and Francis reports, gave a unique insight into the failings within the NHS. A common theme to emerge was how failings were not localised to just the hospitals involved but applicable to the NHS as a whole. The process of instigating meaningful change within the NHS has proved difficult for a variety of reasons, including the sheer size of the organisation.

An innovative approach to medical education that puts patients at the heart of the process is the first part of a long term solution to improving patient safety and the quality of care received. We need to be upfront with medical students about the challenges they face working in the NHS but also provide them with a supportive learning environment which encourages and allows them to make mistakes in the safety of the classroom. In order to make these learning experiences as relevant and applicable as possible it is vital patients are included in these sessions from early on in the course.

Part 3: Problems With Traditional Pedagogy Of Medical Education & Solutions

The medical profession is incredibly conservative and its approach to education and training is no exception. Something no doubt heavily influenced by the apprenticeship model upon which medical training is based (Cooke et al., 2006). From a pedagogical perspective, historically the processes medical students would go through to become doctors involved memorisation of vast quantities of information and then regurgitation of those facts in examination settings. The pace of change and volume of medical advances that have been made in recent years means such an approach no longer prepares students for life as a doctor.

Medical education traditionally involves a pre-clinical phase where basic medical sciences were studied for a period of two to three years followed by a clinical phase. There was minimal patient contact in this initial period and doctors would be produced consistent with the 'Flexner Report' who were 'authoritative, autonomous and independent practitioners'. This is not consistent with what is required or expected from doctors today. For doctors to better meet the healthcare needs and demands of the population, a modified approach to medical education would be beneficial.

Traditionally the approach to medical education involved a significant differential in knowledge levels between doctors and patients, doctors were very much the dominant partner in that relationship and this influenced the way consultations would occur. The doctor-patient dynamic in that era was such that patients would accept the doctor's diagnosis and management plan without challenge and there would be no conversation or discussion. The advent of the internet has dramatically altered the doctor-patient relationship and in many cases medical education and training has not caught up to reflect this significant change. Doctors are now faced with expert patients who will have their own ideas and

challenges about treatment and management. It is the author's opinion the traditional medical education models are not suited to equipping doctors with the skills required to handle such situations.

Does Medical Education's Failure To Change Mean It Is Failing Patients?

Critics have long faulted US medical education for being out of touch with modern healthcare needs (Beck, 2016). The core structure of medical school, two to three years of basic science followed by two to three years of clinical work has been in place since the publication of The Flexner Report in 1910. This is a structure that is not dissimilar to the UK medical education system.

Medicine in the UK is evolving at a rapid pace as the system is becoming more evidence based and patient centred. Much more change is on the horizon with the advent of personalisation and big data influencing healthcare. Despite medicine being unrecognisable from a decade ago, let alone a century, most medical schools in the US and UK are persisting with a medical education model that is over a hundred years old. The reasons for this are complex and involve tradition, resistance to change and difficulty implementing change within large pre-existing and inherently conservative organisations.

The Need For An Alternative

Practising medicine has changed unrecognisably from a century ago. Whether it is interacting with patients who are much more medically literate or working within multi-disciplinary teams. The current systems of medical education have not adapted to take into account such changes thus it could be argued they are not adequately preparing graduates for working life. This is certainly a sentiment shared by students and anecdotally supported by those who supervise newly qualified doctors on the wards. With doctors' roles changing rapidly involving more interaction with medically literate patients the time for increasing patient involvement within medical education is upon us, as this will allow medical students to start honing these skills early in their careers.

Susan Skochelak, the American Medical Association's Vice President for Medical Education, wrote in 2015 that doctors were well schooled in the science of medicine. Yet what has been missing is making students aware of the 'science of healthcare delivery'. Issues such as how to manage chronic disease and focussing on issues such as prevention and wellness are vital to consider. A similar situation occurs in UK medical education where students are taught the basic medical sciences but in a way they struggle to relate to patients.

Despite advances in both educational theory and the field of medicine, as already alluded to, the medical education process has remained largely unaltered over the past century. The teaching of a medical curriculum involves the delivery of complex material, according to (Graffam, 2007) all too often it is delivered in a format that does not facilitate the positive learning engagement recommended by cognitive researchers and theorists (Festinger, 1962). Graffam went on to say transforming pedagogical practice is difficult as medical faculty may not have had much exposure to pedagogical theory or training. This is certainly worthy of consideration among the faculty a new medical school in terms of creating a successful learning environment.

Lecturing

An over reliance on lecturing in the early years of medical school, as while it is a useful way to deliver information, is responsible for many students falling out of love with a subject. While it can be convenient to deliver teaching in this manner, generally it is not conducive to offering meaningful learning experiences for students. Whatever the lecturer does there will either be students who are bored as not challenged or behind and struggling to keep up. With the advent of Google all the information medical students need is at their fingertips. Technology has made it possible for anyone to learn anything, including patients. Whether it is through fear of losing control or logistical difficulties in

delivering teaching in a different way, higher education is not leveraging the incredible learning resources that are available. New medical schools employing innovative approaches to education can unlock this potential.

All too often medical education especially in the early preclinical years is delivered via didactic lecturing methodology which tends towards a superficial passive learning experience. Whereas creating an environment where the students are actively engaging with the material changes the nature of the learning process as has been demonstrated with the success of Maastricht's PBL approach. Educational approaches utilising active learning techniques (Felder and Brent, 2009) not only improves students' knowledge gain and recall abilities but they also find the process more interesting therefore put more effort into it. Sadly these are opportunities not currently heavily utilised in the vast majority of traditional medical education courses.

Basic Medical Sciences

Traditionally the first two to three years of medical school is heavily focused on delivering the basic medical science foundation which can be problematic as often this is not delivered by clinicians. There is a disconnect between the content delivered in lecture theatres in these early years and what is expected of students when they start interacting with patients on the wards. There are many similarities with this situation as in those described by McGilly and Sousa when looking at integrating cognitive theory and classroom practice (McGilly, 1996, Sousa, 2016).

Clinical Teaching

There is a drive among medical schools to try and get an increased amount of clinical teaching into the early years of medical school. This is certainly laudable but faces many challenges. The current working environment in the NHS currently means time is often at a premium as there are competing demands for doctors' time. It is not unusual for the needs of the students and patients to conflict, which in a

service that is becoming increasingly pressured is more and more likely to occur. This is suboptimal and a cause for creating tension given the fact that students are paying significant amounts in tuition fees. Any innovative solution to medical education will need to address the challenges caused by this situation. Spencer also discussed how the clinical environment is generally not teaching friendly, with rewards and recognition for teachers often being poor (Spencer, 2003). This situation has only worsened since 2003. It is a valid point to consider however; as such environments can impact on students' confidence and may mean they avoid clinical settings.

If assessments are orientated heavily towards recall of facts a perfect storm can arise with students avoiding seeing patients, due to the difficulties they encounter, in favour of book work. This highlights the importance of making students resilient early in their training so they can overcome the hurdles they encounter, while also developing assessments that reward students for time invested on the wards and in clinical environments seeing patients.

Improving Patient Care

As discussed by Wong et al, since the turn of the millennium there has been a drive to improve the quality of patient care and preventing recurrence of avoidable errors (Wong et al., 2012). These are important themes to consider when educating medical students given the environment they will be entering. It is vitally important medical students are exposed to such concepts early in their training if they are to positively contribute in creating environments that strive for high-quality patient care. Perhaps most significantly Wong et al went on to conclude 'attention must be re-focussed at all levels of training and instil fundamental, collaborative, open-minded behaviours so the future clinicians are primed to promote a culture of safer high quality care' (Wong et al., 2012).

The Danger Of A One Size Fits All Approach To Education

Despite a fairly dramatic increase in knowledge about different learning styles over the past half a century medical education has not adapted to accommodate different approaches to learning. This is significant as Curry alludes to:-

'If a student's learning style is mismatched with the teaching style or the learning environment, the effort needed to adapt may negatively affect the students' performance.' (Curry, 1999).

An innovative approach to education which takes into account the students learning styles such that both students and teachers are aware of learning styles during curriculum development and delivery can be beneficial. Curry does however also advise proceeding with caution when it comes to medical education, she acknowledges the quickest and most cost effective use of cognitive- and learning-style findings would be providing each student with comprehensive, detailed and interpreted information as it allows students to use that to structure their coping strategies and learning tactics. However, she emphasises that the key to educational and professional success is the ability to be flexible and adapt to different situations including one's individual learning style. So while providing this information may infer benefit to students, caution is needed to ensure it doesn't facilitate students becoming strategic learners favouring some learning styles and ignoring others.

Part 4: Harnessing Students' Changing Relationship With Higher Education Providers To Alter The Philosophy Of Medical Education

UK Higher Education

In Barber et al's paper 'An Avalanche is Coming' they discussed the changes within higher education and foretold they are so significant that should traditional universities stand still in face of such unprecedented change then, as would occur in an avalanche, they would be swept away (Barber et al., 2013). The relationship between students and their higher education providers has changed unrecognisably since the introduction of £9,000 per annum tuition fees. An air of consumerism has become prevalent. This is something that must be guarded against in the context of a medical education establishment, as an attitude cannot prevail amongst the student body where they believe they are paying for the right to become a doctor.

There has been a significant unintended consequence in terms of the effect tuition fees have had on the student population. There has been a noticeable shift in attitude among students and hence culture within the classroom amongst medical students. This is a dynamic which must be considered carefully in the context of establishing a new medical school. A partnership approach needs to prevail where students are felt looked after and guided through the professionalisation process of becoming a doctor. Lincoln Medical School, with an anticipated initial intake of forty students will have a competitive advantage in this regard in the early days. The challenge involves building a curriculum that allows a positive culture of student and staff engagement to continue propagating between the years, thereby creating a real identity of what it means to have graduated as a student from Lincoln Medical School. This will involve capacity within the formal taught curriculum to allow near to peer mentoring, as well as teaching. Fostering links between the years will be essential in creating a culture and identity for all the new medical schools.

Medical education has not kept up with the rate of change within the medical profession and as such is ripe for disruption. Although this will be controversial among the more conservative elements of the medical profession, the changes within higher education means it is inevitable that changes in medical education will occur. The UK could become world renowned for medical education excellence if a co-ordinated approach to the five new medical schools is taken, such that opportunities to innovate are maximised. The importance of the role HEE has to play in setting up a Medical Education Shared Innovation Network (MEDSIN) cannot be underestimated. New medical schools working together can capitalise on maximising first mover advantage (Lieberman and Montgomery, 1988).

It is worth noting that many concepts within this dissertation could be applied on a wider scale within universities around the world. If UoL was successful in implementing these innovative approaches to teaching and learning within a new medical school there is the potential to offer the system on license a model to other medical schools. This has certainly been successful in Maastricht.

The UK Education System & Subsequent Impact On Medical Students

Although there are currently changes being made to the education system in which children in the UK go through, many feel children are generally trained and taught to pass exams. This is particularly relevant for medical students as there is a tacit acceptance they are bright and therefore must know how they learn. This is only partially true. As those who go on to read medicine are amongst the most intelligent in their cohort there is the potential for them to progress with inefficient learning strategies and not maximise their teaching and learning opportunities. As the cognitive burden builds and exams draw closer this becomes increasingly stressful for the students. When medical students start to struggle, given they are so financially invested in the process it should not be a surprise that they become learning objective focussed strategic learners. The author has taught many third year medical students and those who persist with superficial passive learning strategies are in the majority amongst the undergraduate cohorts. This amounts to two years of medical training that hasn't been optimised. There is an argument to be made for undergraduate students to undergo training in learning styles at the beginning of the course in order for them to gain maximum benefit from their time as a medical student.

Maximising The Opportunity Of A New Medical School

The advent of a new medical school provides the opportunity for things to be achieved that would otherwise be impossible if trying to implement in an established school. It is therefore imperative that consideration is given to these issues so Lincoln Medical School can innovate and improve the process of medical education. One aspect vital to consider is a unified philosophy towards learning that both staff and students subscribe to. An important stage in establishing this philosophy will involve interviewing staff and taking on board their views, so the proposals in this document may well be modified following those discussions.

Establishing Quality In Medical Education

Defining what makes a good doctor is challenging (Huxham et al., 1989). There is no clear consensus that fits across all specialities and practising medicine is very much an art within the current NHS environment. There are, however, some core qualities and skills Lincoln Medical School should seek to instil in their graduates. These include problem solving skills, communication skills with both patients and colleagues, team working skills in an inter-professional setting, professionalism, resilience as well as a lateral thinking and a holistic approach to considering patient problems. The way the curriculum is delivered and how students are assessed will have an impact on all of these areas. It is vital the teaching, learning and assessment methodology is considered in terms of its impact on achieving a common approach to learning within Lincoln Medical School.

Importance Of Establishing The 'Lincoln Learning Philosophy' (LLP)

The Lincoln Learning Philosophy (LLP) is also an important concept given Lincoln Medical School will initially be working with a partner medical school whose curriculum they will be delivering. In terms of the future prosperity of the medical school it is critical Lincoln has its own identity from day one. With planning and foresight this identity can be built upon in the future when the medical school is in a position to award degrees of its own accord.

An important consideration to be taken with this curriculum involves clearly defining the activities of teaching and learning among the staff and students. Those who teach medical students should approach each encounter with the intention of inducing learning. There will be a range of tools and frameworks developed and shared among the staff body in order to facilitate this process.

A common mistake among educators is they falsely assume once they explain something, students absorb that information straight away. Cognitive psychology (Crowder, 2014) tells us the learning process does not occur that way. Incorporating recapping of information and self-test in conjunction with constructivist learning methodology means optimal learning environments can be created. Making students aware of the educational theory and ways of learning can only be a positive thing and will also act as a differentiator.

A vital factor in the success of getting the LLP widely adopted within the medical school will involve getting the student body to buy into the process of, where necessary, converting their learning style from superficial passive learners into deep active ones (Schmeck, 2013). Making medical students aware of educational theory and providing a personalised approach to learning will help with this process.

Once this approach is established and translates into good feedback on the NSS it will act as a strong differentiator for the medical school in terms of attracting new students, in subsequent years.

Students have an increasingly powerful voice via the NSS and their capacity to leverage reputational risk on their university is immense. This can have negative financial connotations with a reduction in applications and student numbers. This arrangement leaves medical schools in a somewhat precarious position, educational curricula and assessment methods must be sufficiently robust to ensure graduates meet the required GMC competencies but this must be delivered in a supportive environment to protect medical students from what is a physically and psychologically demanding course. Introducing the proposed novel and innovative elements to the curriculum will go a long way to equipping students with the generic skills and strategies required for them to not only cope but prosper reading a course as intensive as medicine. Such skills will also be useful for their working lives. Being upfront, open, honest and offering students innovative approaches to elements of the curriculum should help insulate institutions from bad NSS feedback, but this involves a proactive approach from all parties at the beginning of the course.

Creating a supportive and innovative learning environment is pivotal to future prosperity of the new medical school and as has been shown with the difficulty surrounding implementing organisational change in large organisations, the time to achieve this is in the early days of the new medical schools, hence the importance of considering these matters early in the curriculum development process.

This proposal for the LLP, seeks to prevent a lot of the common problems within medical education from occurring. It centres on creating an environment where students are encouraged to become deep active learners, such that they maximise their time as an undergraduate, as well as becoming caring and compassionate physicians taking a holistic view of their patients' healthcare needs.

Lincoln's Learning Philosophy & Potential Impact On Higher Education

The days of a one size fits all approach to education are numbered. The formation of a new medical school gives the opportunity to positively influence the approach to learning impressed on its students. Those institutions that rise to meet the challenges of individualising the delivery of a curriculum to maximise the educational opportunities for their students are likely to fare better in an increasingly competitive higher education environment. With medical students paying significant fees and getting into upto £100,000 of debt for their undergraduate degree they are, rightly so, becoming more demanding and wanting high quality experiences in medical education.

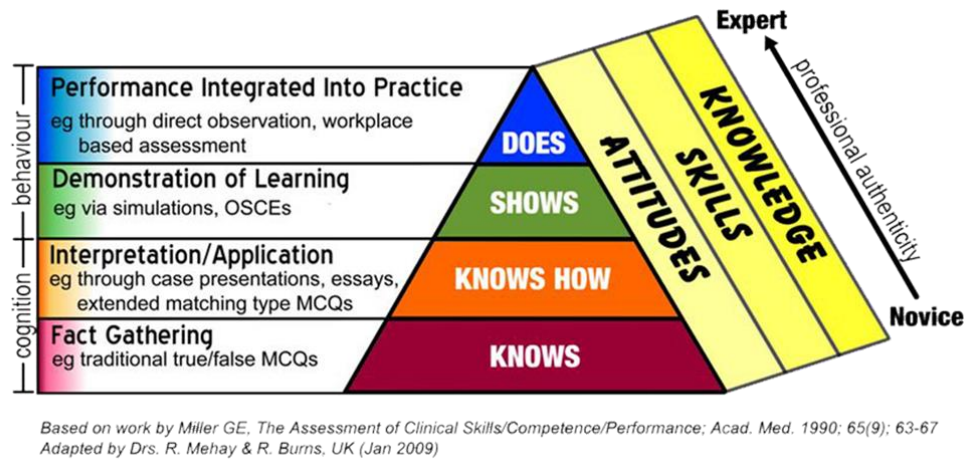
Institutions which create environments conducive to individualised learning are likely to be rewarded with high student satisfaction scores on the NSS. The converse is also true a failure to shift in this direction will increase the likelihood reputational risk is leveraged on the university and they may well struggle with recruiting students onto their medical courses.

Conclusions

In conclusion, a vital part of the LLP revolves around acknowledging the role of a doctor as a teacher, given their role as patient educators of the future. The Latin word for doctor means 'teacher' so the origins of the profession have always involved teaching. Yet it is only recently, within the last decade, that students' learning how to teach has been the subject of attention within undergraduate medical education. Dandavino et al reviewed the medical education literature and found reports on three main areas. Firstly, students with a better understanding of teaching and learning principles can become better learners themselves. Secondly, equipped with this teaching and learning knowledge students can become better patient educators as future professionals. Finally, exposure to these skills early is beneficial as students are more likely to have teaching roles as their careers progress (Dandavino et al., 2007).

With Dandavino's review in mind a core component of the LLP should revolve around teaching and training medical students on educational techniques and strategies, interestingly this is absent from the majority of medical school curricula. Miller's 'Prism of Clinical Competence' (Taylor and Hamdy, 2013) classically consists of the four sequential domains of 'knows', 'knows how', 'shows' and 'does', as illustrated in Figure 1. The LLP should take the approach taken in Maastricht and look to build on that by adding 'teaches' and 'teaches teachers' on to Miller's classical approach.

Figure 1 - Miller's Prism of Clinical Competence



Part 5: Learning from Innovative Institutions Instrumental In Successfully Changing The Pedagogy Of Medical Education

Introduction

Having already established the medical profession is inherently conservative and implementing change within medical education can be a somewhat challenging task, it is worth looking at examples from around the world where they have been successful in implementing such change. Through analysis of their journey and how processes have evolved it will provide valuable insights for new medical schools looking to innovate within UK medical education.

McMaster University - Canada

The birthplace of PBL is widely considered to be at McMaster University, (Neufeld and Barrows, 1974) Canada. In 1966, a small but influential group of educational innovators put together a new curriculum. Professor Jim Anderson is considered the creator of PBL with learning taking place in small groups of students. Another innovative idea to come out of McMaster was the idea of presenting real-life patient problems and the use of simulated patients for educational purposes (Barry Issenberg et al., 2005). This has been taken into account for the recommendations made in Part 6.

Maastricht University, Faculty Of Health, Medicine & Life Sciences (FHML) - Netherlands

One institution that is worth paying particularly close attention to is The University of Maastricht. In 1974 The Faculty of Health, Medicine and Life Sciences (FHML) was founded and tasked with introducing an innovative curriculum to tackle high dropout rates and graduates not being prepared for practise once they start work, these are similar to the problems faced within UK medical education currently. As a newly formed institution the FHML was freed from the many difficulties of instituting change within an established organisation and had appropriate resources, leadership and organisation to maximise this advantage.

The FHML at Maastricht has been successfully delivering their innovative curriculum for over forty years, so is now considered an 'established' school given their once innovative PBL approach to medical education has now become routine. Like all true innovators those associated with Maastricht have been keen to share their experiences so that others can benefit and collaborate. As such there is a significant literature base which provides valuable insights. This section will explore some of the challenges and triumphs experienced at Maastricht, so that new medical schools can learn from these experiences and have the best chance of success when implementing their own innovative approaches to medical education.

External Environment Creating Conditions For Change

Towards the end of the 20th and beginning of the 21st century the way we have come to understand the processes behind learning have been revolutionised. In certain disciplines including science, technology, engineering and mathematics new approaches embracing active learning have been adopted and shown to be beneficial as elaborated upon in Issenberg's systematic review (Barry Issenberg et al., 2005).

Based on the apprenticeship model of the professional guilds, medicine has long been a bastion of traditional learning. The social environment around Maastricht in the 1970s was one which was amenable to change. Medical advances had essentially come to a standstill and doctors were faced with an upsurge in complaints from the 'worried well'. In an excellent analysis in 'The Rise and Fall of Modern Medicine' (Le Fanu, 1999) this upsurge in complaints were attributed to concerns surrounding the 'undesirable and costly medicalisation of society'. Around the turn of the millennium when Le Fanu's book was published experienced teachers and clinicians were also questioning modern healthcare and became convinced more emphasis on the societal aspects of healthcare was called for both in medicine and the education of future doctors.

There was also another serious cause for concern with regard to medical education: the volume and changeability of medical knowledge. It was no longer feasible to memorise and gain mastery of medical knowledge in its entirety. Therefore educational models that encouraged this ran the risk of becoming woefully out of date and not fit for purpose. This is not dissimilar to many of the medical education practises in the UK. There are many remnants within UK medical education where the rote learning of facts is encouraged. This means there is definitely scope for a new approach.

For the first time since the advent of The Flexner Report in 1910, a change in how to approach medical education was being considered. No longer was the purpose of the teacher seen as being the transmitter of knowledge and information to the student (Bleakley, 2006, Doll Jr, 1989). This was significant as the differences between teaching and learning became apparent. The process of learning had a very different meaning to the traditional didactic methods of teaching that had gone before. Consideration was given to the learning processes and environments students were exposed to. There was also an increased emphasis on sessions being interactive and encouraging the social processes surrounding learning between students. These are vital factors for the five new medical schools to consider.

Medical students and patients have increasingly powerful voices and both are demanding change. Considering the societal factors in the external environment that brought about the revolutionary changes in Maastricht is relevant as there are several parallels with the situation faced within UK medical education today.

Course Structure

Initially at Maastricht students would spend their four pre-clinical years of their six year curriculum using paper cases of patient problems as the starting point for learning. This approach was designed to 'promote the transfer of knowledge concepts to new problems and the integration of basic science concepts into clinical problems' (Norman and Schmidt, 1992). Despite the theory this did not translate into practise and students struggled transitioning from their theoretical pre-clinical years to the mainly workplace based clerkship years (Prince et al., 2005). Students had no idea how to apply the knowledge they had acquired when confronted with real patients (Prince et al., 2000). This is important for new medical schools to consider in order for this 'shock of practice' to be avoided.

Importance Of A Shared Culture

One of the main reasons Maastricht was successful in innovating was their ability to create a shared culture which inspired staff and students to strive for educational excellence. It is also worth considering the external environment which influenced that culture. If a new medical school is going to succeed in developing their own identity and change the culture within UK medical education it would do well to learn from the many parallels that can be drawn from the experiences of Maastricht.

Guiding Philosophy Of Educational Principles

The philosophy FHML took to medical education was guided by a synergy with the founding principles of Maastricht University. This synergy was important as to ensure conflict was not introduced. FHML's educational philosophy was based on four principles. Firstly, cases would be taught around problems to halt the division of disciplines. Secondly, attitude development was considered where more attention was paid to the interpersonal and emotional components of healthcare; this was interesting as was challenging the traditional paternalistic approach to how medicine was practised. Thirdly, there was a desire to increase student participation in the course. Finally, there was a preference for progress

evaluation as an alternative to final year examination. These four principles are also worth considering and building upon for any innovative approaches to UK medical education.

Problems Encountered During The First Years Of PBL

Tensions were evident from the beginning between pre-clinical and clinical disciplines (van Berkel, 2010). When a student centred approach is implemented a by-product of that means medical disciplines have to surrender some of their autonomy. There was some concern from professors that their academic freedom was at stake. Another common misconception was the number of timetabled hours being interpreted as an indication of the relevance of the subject. Tensions between educational and research parts of universities are often commonplace and this was no different to the situation experienced in Maastricht during the formative years of their innovative PBL curriculum. The problems faced by the medical faculty in the early years of PBL in Maastricht are worth considering hence avoiding such pitfalls in the future.

Investing In Teaching Staff

From the beginning Maastricht recognised the critical importance of informed teaching skills if they were to succeed in fostering a different approach to learning. Staff development involving deliberate practise (Ericsson, 2004) formed a vital component of their approach. There was a definitive and deliberate emphasis on 'learning' rather than 'teaching' and students were encouraged to make connections and discoveries through collaborative dialogue. The team at Maastricht also found taking such an approach prompted students to formulate questions at the frontiers of their understanding and drive self-directed learning in a meaningful way. To encourage such an active approach to learning at the time was novel and these skills are required even more today given the rapid pace of change within medicine.

Maastricht also found as the course developed so too did the need for systematic development of teacher's pedagogic abilities. This was considered an essential part of the role and could not be viewed as an optional extra. It was found having a proactive approach to staff development was beneficial. Through valuing faculty development, scholarship and research to understand learning at the level of the individual, group and institution they created an innovative culture surrounding their educational processes. They also proved teaching mindfully is a powerful source of learning. This was achieved through providing learning opportunities relevant to the priority health needs of society as their most important activity and they have been consistent in achieving this over the years. Engaging in research into how students learn created productive learning environments and increased student satisfaction. In order for their innovative approach to be sustainable continuous reflection and a supportive infrastructure was critical.

Maximising The Potential

Given Maastricht was established as a new medical school there was no resistance to change encountered and this allowed them to embark on what many saw as quite a revolutionary approach to medical education. They also had appropriate resources, effective leadership and were well organised. The PBL nature of their course promoted explanation and questioning at the limits of students understanding. Students were then encouraged to undertake self-directed, inquiry based learning in contexts relevant to the health needs of the society.

Maastricht's PBL programme was very good at integrating basic medical sciences with the clinical sciences, meaning they were less frequently encountered as disarticulated and fragmented disciplines. Given its introduction forty years ago, some may ask is PBL still relevant to medical education. What is relevant is learning and elements of PBL can provide transformative, enduring experiences that promote a deep active approach to learning - something new medical schools should seek to foster via various mechanisms of delivery be they PBL, small group teaching, seminars, or lectures.

One of the key elements of Maastricht's transformational curriculum was 'Rigor'. By that they meant purposefully looking for different alternatives, relations and connections. Essentially looking for and uncovering the assumptions that underlie our understanding. This is especially relevant today in a world where the process of educating health care professionals is rapidly changing and there is a real focus on the capability of learners to frame new questions, define problems and seek understanding in new situations.

Part 6: Proposals For Introducing Innovation Within UK Medical Education & Opportunities For New Medical Schools

The advent of new medical schools poses a unique opportunity to positively shape the quality and safety of healthcare delivered to NHS patients over the longer term. This can be achieved by taking a fairly radical approach to medical education considering what knowledge, skills and values we require doctors to be equipped with. This will enable newly qualified doctors to prosper in an increasingly complex healthcare environment. Medical schools that achieve this have the potential to influence medical education on a national level and the recognition that would attract would be invaluable for building the reputation of new medical schools. As illustrated by events in Maastricht new medical schools are the place where such innovative approaches are likely to succeed. With the announcement of five new medical schools in April 2018, this provides England a unique opportunity to shape medical education just like Maastricht did. This will however require a co-ordinated approach, Health Education England (HEE) are probably best placed to oversee this process.

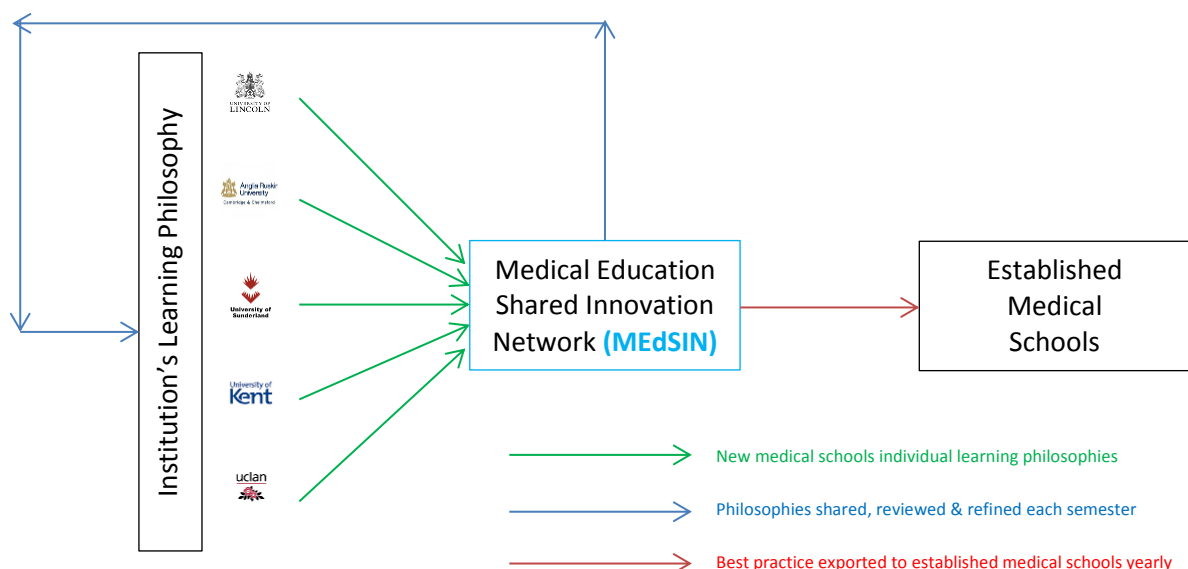
One of the key factors when it comes to an innovative approach to medical education will involve jettisoning elements of the curriculum that remain purely out of tradition. This also includes the cultural aspects that revolve around the paternalistic nature of how medicine has been practised in the past. Below is a summary of the proposals which will be elaborated on in further detail throughout this chapter:-

- a) Institutional approach to teaching & learning,
- b) Ensuring clinical relevance throughout the course,
- c) Utilising technology,
- d) A common shared structure for new medical schools,
- e) Conclusions, Next Steps & The Medical Education Shared Innovation Network (MEdSIN).

6a) Institutional Philosophy To Teaching & Learning

What is being proposed is very different to current practices in medical education. Therefore a common approach towards teaching and learning, shared amongst new medical schools, is essential in order for a cohesive approach to be taken, both within individual organisations and the network of five new schools. There will, of course, be allowance for local variation, as illustrated with the LLP, but the core parts of the approach should remain broadly similar across the new medical schools. This relationship and how the individual medical schools feed into the Medical Education Shared Innovation Network (MEdSIN) are shown in Figure 2.

Figure 2 - Individual Institution's Learning Philosophies Relationship With MEdSIN.



Distinguishing Between Teaching, Learning & Assessment

Teaching, learning and assessment are important concepts to consider when establishing a new medical school as how these activities are delivered will influence organisational culture and both student experience and behaviour. Students commonly equate the information taught to them as the information they must learn and regurgitate for exams. This means less emphasis is placed on self-study and vicarious learning in clinical environments. It is also important to clearly emphasise the importance of teaching and learning being two very different processes, hence guarding against strategic learners who are solely focussed on passing assessments.

What Should An Innovative Medical School Strive To Provide?

An innovative medical school needs to strive to provide deep active educational experiences focussed on long term retention and recall rather than superficial exercises in memorisation. It is well accepted within educational literature, examinations drive student behaviour when it comes to learning. If tests can be written in such a way they reward deep, active and experiential learning the outcome in preparing doctors that are fit for purpose is more likely to be realised. Allowing students to develop a reflective learning log where students map competencies to real life cases they have been involved would also be beneficial. As outlined above given the educational environments students are in prior to attending medical school, changing their mindset may be a challenge, but if successful there are great opportunities both for their education and the impact they can have on the NHS.

There is a growing body of evidence that suggests there is great benefit to be derived from incorporating patients into the earliest stages of medical education (Bleakley and Bligh, 2008). Course design for new medical schools should make this a priority and suggestions are made how this could be achieved later in this chapter. When considering the role of patients in medical education it is worth considering a famous quote by English physician Sir William Osler who said:-

'Those who study medicine without books sail an unchartered sea, but those who study medicine without patients do not go to sea at all.'

This quote is as relevant today as it was in Sir William Osler's day for a number of reasons pertaining to the challenges students face in terms of getting access to patients on the wards, within NHS environments which are currently incredibly stretched and getting worse year on year.

Innovation within undergraduate medical education can provide the opportunity for students to be involved with patient journeys throughout their stay in hospital. This would mean students establish a routine of seeing patients regularly as part of their educational programme. This coupled with a reflective journal where students could map learning to cases offers a degree of autonomy and control over their learning. The current system tends towards students seeking out diagnoses and tick that box, rather than looking for patients and considering in a holistic manner how the disease process impacts them and affects their life. Curriculum and assessment design is critical in getting students to demonstrate behaviours desired from future doctors.

Reinventing The Lecture

Although the traditional format of lecturing has had its critics and effectiveness questioned (Palis and Quiros, 2014) it does have its advantages if delivered in the right way. Many authors suggest (Clark, 2014, Stahl and Davis, 2011, Bransford et al., 2000) the application of adult learning principles such as relevance, congruence with student's needs, interactivity (Bonwell and Eison, 1991) and connection to student's previous knowledge and experience (Norman and Schmidt, 1992) can increase the effectiveness of its delivery. A new medical school developing a new curriculum has the advantage of considering what it wants to achieve via lecturing. Ensuring lectures are no more than thirty minutes in duration and deliver key concepts where the clinical relevance is made clear would serve as an excellent introduction to small group work and problem based learning. It would also form the foundation for allowing patients to be introduced at the earliest possible phase and the simultaneous delivery of clinical and communication skills - subjects currently often taught separately. In order to achieve this it would require oversight from a curriculum development committee and would tie in closely with the learning philosophy of the new medical school.

An Innovative Approach To Learning

Higher education and especially time at medical school is markedly different from the educational environments students have previously been familiar with. This means medical student's perception of learning is generally associated with passing exams through short term retention and recall of facts. One of the current failings of medical schools is an assumption that being bright medical students are aware of how they learn. The author would argue in his experience of teaching medical undergraduates more often than not this assumption is incorrect. This is significant as the volume of information medical students are expected to gain mastery of is immense and equivalent to learning a new language. There is very little scope for students to persist with inefficient learning styles and succeed. What arises in such a situation is medical students become exam focussed strategic learners as they are of course keen to fulfil the assessment requirements. It is vital to consider this when writing assessments for new medical schools in order to ensure a holistic approach to practising medicine among undergraduate students. If new medical schools are going to succeed in getting students to modify their approach to studying it is critical consideration is given to teaching and learning methodology at the start of their medical course. This will allow students to identify the methods which suits them best while seeking to develop areas where they have deficiencies.

Knowing How Individuals Learn

The importance of knowing how individuals learn is a critical component of introducing an innovative approach to medical education. There is a growing body of evidence (Bransford et al., 1999) demonstrating positive connections between classroom activities and learning behaviours, being mindful of these at the onset of curriculum design is critical to the success of implementing an innovative patient based approach to medical education.

The Importance Of Knowing How Individuals Learn

For clinical teachers to have an understanding of how individuals learn is vitally important for every learning interaction to be maximised. If teachers have an understanding of different learning styles it would allow them to be more effective in their interactions with students. Traditionally the transient nature of interactions with students would mean this information is not sought, so to make it a regular occurrence will require a culture change. As demonstrated by Maastricht faculty development is essential in this regard.

Lessons Learned

As already established the amount of medical knowledge is expanding at a relentless rate, such that it is impossible for students to memorise in its entirety. Yet by persisting with encouraging superficial learning strategies without consideration to individual students learning styles a significant burden is placed on medical undergraduates in the first few years of their course. If new medical schools invest time in students' development, at the beginning of the course, such that the process of learning can be as efficient as possible, students' time can be maximised both in the classroom and clinic where they are exposed to experiential learning experiences, which are then matched with appropriate assessments to aid their transition to becoming a foundation doctor. If delivered successfully this should lead to increased levels of student satisfaction.

6b) Ensuring Clinical Relevance throughout The Course

From Cells To Symptoms & Signs

Particularly true for the pre-clinical years, a vital function of those who design course structure for new medical schools will be ensuring clinical context is clearly demonstrated to students. This will require clinicians input from the earliest stages. This can be packaged in a theme that runs throughout lectures, seminars and tutorials where the basic medical sciences are covered, where normal function is discussed in addition to when it goes wrong and what the resulting symptoms and signs are. Whilst this sounds like something that should already be occurring, the reality of the situation is with increasingly congested medical school timetables this clinical emphasis has been lost and its delivery is left until later in the course. New medical schools have the opportunity to review this.

Preparation For Democratised Medicine

The digitisation of medicine somewhat took the medical profession by surprise. We must prepare medical students for the democratisation of medicine and how to handle patient populations empowered not only by knowledge but also their own data. Just as technology has disrupted many other industries patients collecting and collating their own health data will pose many challenges for the clinicians involved in delivering care. The democratisation of healthcare is already challenging the status quo. The impact this has caused within the medical profession has been seismic and divisive in some quarters as illustrated by this national newspaper headline from October 2017 'GPs to Block Patients Who Check Dr Google'. Further information, where the topic was discussed Live on Sky News Sunrise newspaper review, can be viewed here - <https://youtu.be/tyqY-XAc8Dw>.

Clinical situations within the NHS prove to be challenging learning environments. The approach to equipping students with the skills, knowledge and attributes required to thrive in these circumstances are detailed in 'Part 6d) A Common Structure for New Medical Schools'.

6c) Utilising Technology

Doctors For The Digital Era

In 'The Patient Will See You Know' Eric Topol, one of America's most disruptive physicians examines what he considers to be medicine's 'Gutenberg moment' much as the printing press liberated knowledge from the control of an elite class, new technology is poised to further disrupt the doctor-patient relationship (Topol, 2015). Digitisation and the smart phone have already disrupted a raft of industries and medicine is the next on the list, whether the medical profession likes it or not. New medical schools have the opportunity to positively impact upon the doctor-patient relationship by equipping students with the skills to function as a doctor in the digital era. The doctor-patient relationship will be radically altered with patients in control of a vast amount of data from sensors, images, labs and genomic sequencing. Topol coins the phrase 'terabytes of data from womb to tomb'. This is an interesting concept as data would be stored ready for analysis as and when needed and potentially to prevent illness before it even happens. This potentially places the future role of doctors as the trusted professionals who can help patients navigate this sea of data. New medical schools need to be mindful of this and incorporate the development of such skills into their curricula. There are also technological solutions such as having a 'virtual firm' where team members are connected electronically to discuss cases. This would however be more suited to non-clinical skills orientated tasks, so must not be used as a substitute for hands on experience.

Hyper-connected Patients

Social media has allowed those with rare diseases or complications to aggregate, share knowledge and potentially unlock the genetic sequencing of rare diseases. Online health communities are vital to how healthcare will be practised in the future. Given Facebook has 1.3 billion registered users, roughly equal to the population of China, there is great potential for patients with like conditions to connect and learn from each other without the constraints of time or place. This in turn paves the way for great advances to be made in how patients manage their own diseases. Such a changing landscape provides unique

opportunities for medical students to not only learn about diseases, but also how these diseases affect patients, through interacting with them in virtual learning environments.

6d) A Common Shared Structure For New Medical Schools

The following proposed outline has been devised taking into account many of the problems currently faced by medical students. Implementing a common structure across the new medical schools allows for uniformity in educational experiences delivered to the students and shared best practise.

Early Patient Contact (EPC) & Early Clinical Exposure (ECE)

Within the earliest parts of semester one, students should be exposed to not only patients via EPC, but also the clinical environments they will be in when interacting with patients when on the wards through ECE. This will allow students to gain an understanding of the challenges of learning in such environments that are not specifically designed for teaching. The opportunistic approach required should be highlighted also. EPC should involve patients being brought into preclinical lectures so students can immediately gain an appreciation of what impact certain pathophysiology has on patients. It will also allow them to gain an appreciation of how best to learn from clinical cases. Patient contact and clinical exposure needs to continue regularly throughout the pre-clinical years so that the foundations are laid for when students' progress into their clinical years.

Focussed On Call University Shadowing (FOCUS)

When medical students are in their clinical years they are often left isolated, given the removal of the firm structure. This can mean they are often left to their own devices. When ward environments are busy, they can be unwelcoming for students. If this is coupled with a situation where exams are knowledge focussed there can be several incentives for students to spend more time in the library rather than the wards. FOCUS would give medical students specific activities they can engage in by shadowing healthcare professionals and then reflect on these with clinical teaching fellows and other

teaching staff at a later date. A staged approach to FOCUS will build towards students achieving the competencies required for their first day working as a foundation doctor.

Patient Based Medical Education

A generic theme tying together this innovative approach to medical education involves placing patients at the heart of all teaching from scientific, clinical and communication skills perspectives. As such a new medical school would be well advised to curate a database of patients with stable conditions who can come in and be involved with teaching medical students in the first years. Having a clear strategic vision for the kind of educational processes within a new medical school is essential. This will allow them to circumvent the challenges of implementing this approach within pre-existing medical schools as it requires simultaneous changes in curriculum, instruction and assessment practises (Barron et al., 1998). This can be a challenge as such changes are often foreign to both students and teachers. As such medical curriculum redesign is generally a complicated process and the potential for failure is high, this highlights the necessity for new medical schools to get it right first time.

6e) Medical Education Shared Innovation Network (MEdSIN)

On the 20th of March 2018 five new medical schools were announced in England with the chosen sites in Lincoln, Chelmsford, Sunderland, Canterbury, and Lancashire. This represents a unique opportunity for Health Education England (HEE) to collaborate with these institutions and introduce much needed updates to the medical education process. With the first intake of students due in September 2019 this provides a window for such changes to be planned. The formation of a network linking the new medical schools is vital as it will allow for best practise to be shared within the schools, processes refined and then exported outside the network to instigate change within existing medical schools. This is significant as many of the pre-existing medical schools may perhaps be more conservative in their approach to innovation in medical education. Ultimately getting new medical schools working together (Tidd et al., 1997) in a collaborative and collegiate manner requires consideration of the effects of networks on

innovation management (Tidd, 1997). This will not only increase their chances of success but also the likelihood of spreading best practise to other medical schools.

Conclusions

The changes Maastricht brought to medical education were significant, perhaps the most radical overhaul since the Flexner Report of 1910, which has shaped medical education for a century. A hundred years ago the parameters that could be measured were limited to simple observations such as pulse, temperature, blood pressure and respiratory rate. As such medical education was based on the interpretation of these measurements. Not only has the healthcare landscape changed unrecognisably, in the intervening period, so too has the amount of technology that it being applied to healthcare. The advent of big data, machine learning, artificial intelligence and genomics are set to add additional layers of complexity to the practise of medicine. The healthcare professionals of tomorrow need to be trained in the application of these disciplines and they will also need to be able to navigate patients through the vast array of new treatment options.

Correcting Medical Asymmetry

'Doctors orders' and 'Doctor knows best' are phrases that fuel authoritarian tendencies which become self-fulfilling in terms of the paternalistic nature medicine is practised. Much of the doctor-patient relationship has traditionally been based with such an approach in mind. Thanks to the advances of technology the knowledge gap between physician and patient is narrowing. In some cases, with patients in charge of their own health data, they actually hold information and can decide with which medical professionals to share their data. These changes really are seismic and as such should be considered when training doctors. It will take the end of paternalism in medicine for doctors and patients to develop a healthy relationship on equal footing. New medical schools with an updated philosophy to the principles and practise of medicine have the potential to positively shape this process.

The Healthcare Revolution & Challenges For Medical Educators

The UK healthcare landscape in which newly graduating doctors work within is currently undergoing great change. Both the ageing patient cohort with increasingly complex diseases requiring multi-disciplinary input and the range of professionals involved in the delivery of this care are unrecognisable from conditions a mere decade ago. This poses challenges for newly qualified doctors on many levels. Firstly, not only are their patients suffering from more complicated diseases but they are far more knowledgeable about their conditions with access to the same medical sources as their doctors. Secondly, there are increasingly complicated and sophisticated treatment pathways for numerous medical conditions where patients will be coming into contact with a host of allied healthcare professionals. Thirdly, we are starting to see a digital revolution in health surrounding big data. Patients are increasingly collecting their health data, so not only do they have access to the medical knowledge, but they are also empowering themselves with their own health data. This significantly changes the doctor-patient dynamic and medical education currently does not take into account these challenges. The world of personalised care is not far away and currently the system is setting new graduates up for an incredibly steep learning curve. Medical education has remained largely static in light of this changing landscape. Traditionally medical schools have not been good at the rapid application of new technology to curricula. A prime example being the use of portable ultrasound machines is not widely taught to medical undergraduates. Despite such scans being far more accurate and able to provide objective evidence of pathology, within an undergraduate medical education environment we remain tethered to our stethoscopes, which provide subjective information that is hugely open to interpretation by individual clinicians. In order to best prepare medical students for life as tomorrow's doctors we must anticipate and pre-empt these forces, which are already revolutionising healthcare, and introduce innovative ideas in environments traditionally resistant to embracing change.

By introducing the innovative changes suggested, it acknowledges the need for a different type of doctor who is equipped with the problem solving, communication, lateral thinking and generic professionalism skills needed to allow them to contribute to and lead multi-disciplinary teams in the NHS which is a challenging and complicated healthcare environment. In implementing such an innovative approach to education new medical schools will help tackle some of the current problems with medical education and produce doctors that seamlessly integrate within cohesive high performance teams (Castka et al., 2001) where excellent quality care and patient safety is at the forefront of everything they do.

Next Steps

This dissertation will be shared with, those listed below, in order for the proposals to be considered and potentially implemented.

- Prof Sheona Macleod, Deputy Director for Medical Education Reform, Health Education England,
- Prof Sara Owen, Pro Vice Chancellor & Head of College of Social Science, University of Lincoln,
- Prof Tony Young, National Clinical Lead for Innovation, NHS England,
- Mr Paul Summerfield, Development Director, Royal Society of Medicine,
- & Prof Simon Mosey, Supervisor and Chair of Hayden Green Institute, University of Nottingham.

Dr Kishan Rees
Clinical Teaching Fellow
NHS England Clinical Entrepreneur
London, April 2018

References

- AYLIN, P. & MAJEED, F. A. 1994. The killing season--fact or fiction? *BMJ: British Medical Journal*, 309, 1690.
- BARBER, M., DONNELLY, K., RIZVI, S. & SUMMERS, L. 2013. An avalanche is coming. *Higher Education and the revolution ahead*, 73.
- BARRON, B. J., SCHWARTZ, D. L., VYE, N. J., MOORE, A., PETROSINO, A., ZECH, L. & BRANSFORD, J. D. 1998. Doing with understanding: Lessons from research on problem-and project-based learning. *Journal of the Learning Sciences*, 7, 271-311.
- BARRY ISSENBERG, S., MCGAGHIE, W. C., PETRUSA, E. R., LEE GORDON, D. & SCALESE, R. J. 2005. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. *Medical teacher*, 27, 10-28.
- BECK, A. H. 2004. The Flexner report and the standardization of American medical education. *Jama*, 291, 2139-2140.
- BECK, M. 2016. *Innovation Is Sweeping Through U.S. Medical Schools - Preparing doctors—and in greater numbers—for new technologies and methods* [Online]. The Wall Street Journal. Available: <https://www.wsj.com/articles/innovation-is-sweeping-through-u-s-medical-schools-1424145650> [Accessed 05 SEP 17].
- BILÁN, S. G., KISENWETHER, E. C., RZASA, S. E. & WISE, J. C. 2005. Developing and Assessing Students' Entrepreneurial Skills and Mind-Set. *Journal of Engineering Education*, 94, 233-243.
- BLEAKLEY, A. 2006. Broadening conceptions of learning in medical education: the message from teamworking. *Medical education*, 40, 150-157.
- BLEAKLEY, A. & BLIGH, J. 2008. Students learning from patients: Let's get real in medical education. *Advances in Health Sciences Education*, 13, 89-107.
- BONWELL, C. C. & EISON, J. A. 1991. *Active Learning: Creating Excitement in the Classroom*. 1991 ASHE-ERIC Higher Education Reports, ERIC.
- BRANSFORD, J. D., BROWN, A. & COCKING, R. 1999. How people learn: Mind, brain, experience, and school. *Washington, DC: National Research Council*.
- BRANSFORD, J. D., BROWN, A. L. & COCKING, R. R. 2000. for the Committee on Developments in the Science of Learning and the Commission on Behavioral and Social Sciences and Education of the National Research Council, editors. *How people learn: brain, mind, experience, and school*.
- BROWN, J. S., COLLINS, A. & DUGUID, P. 1989. Situated cognition and the culture of learning. *Educational researcher*, 18, 32-42.

- CASTKA, P., BAMBER, C., SHARP, J. & BELOHOUBEK, P. 2001. Factors affecting successful implementation of high performance teams. *Team Performance Management: An International Journal*, 7, 123-134.
- CENTOR, R. 2015. *These are the words medical educators should think about* [Online]. Available: <http://www.kevinmd.com/blog/2015/12/words-medical-educators-think.html> [Accessed 05 SEP 17].
- CLARK, B. R. 1998. *Creating entrepreneurial universities: organizational pathways of transformation. Issues in Higher Education*, ERIC.
- CLARK, R. C. 2014. *Evidence-based training methods: A guide for training professionals*, American Society for Training and Development.
- COLLINS, A. & HALVERSON, R. 2009. *Rethinking education in the age of technology: The digital revolution and schooling in America*, Teachers College Press.
- COOKE, M., IRBY, D. M., SULLIVAN, W. & LUDMERER, K. M. 2006. American medical education 100 years after the Flexner report. *New England journal of medicine*, 355, 1339-1344.
- CROWDER, R. G. 2014. *Principles of learning and memory: Classic edition*, Psychology Press.
- CURRY, L. 1999. Cognitive and learning styles in medical education. *Academic Medicine*, 74, 409-13.
- DANDAVINO, M., SNELL, L. & WISEMAN, J. 2007. Why medical students should learn how to teach. *Medical teacher*, 29, 558-565.
- DICKINSON, L. 1995. Autonomy and motivation a literature review. *System*, 23, 165-174.
- DOLL JR, W. E. 1989. Foundations for a post-modern curriculum. *Journal of Curriculum Studies*, 21, 243-253.
- ERICSSON, K. A. 2004. Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. *Academic medicine*, 79, S70-S81.
- FELDER, R. M. & BRENT, R. 2009. Active learning: An introduction. *ASQ Higher Education Brief*, 2, 1-5.
- FESTINGER, L. 1962. *A theory of cognitive dissonance*, Stanford university press.
- FLEXNER, A. 2002. Medical education in the United States and Canada. *Bulletin of the World Health Organization*, 80, 594-602.
- FRANCIS, R. 2013. *The Francis Report - The final report of the Mid Staffordshire NHS Foundation Trust Public Inquiry* [Online]. Available: <http://webarchive.nationalarchives.gov.uk/20150407084003/http://www.midstaffspublicinquiry.com/report>.

- GABA, D. M. & HOWARD, S. K. 2002. Fatigue among clinicians and the safety of patients. *New England Journal of Medicine*, 347, 1249-1255.
- GEORGE, G., JELL, C. & TODD, B. 2006. Effect of population ageing on emergency department speed and efficiency: a historical perspective from a district general hospital in the UK. *Emergency Medicine Journal*, 23, 379-383.
- GODIN, S. 2010. The Coming Meltdown in Higher Education (as Seen by a Marketer). *Chronicle of Higher Education*.
- GRAFFAM, B. 2007. Active learning in medical education: strategies for beginning implementation. *Medical teacher*, 29, 38-42.
- HALL, G. E. & HORD, S. M. 2006. Implementing change: Patterns, principles, and potholes.
- HUXHAM, G., LIPTON, A., HAMILTON, D. & CHANT, D. 1989. What 'makes' a good doctor? *Medical education*, 23, 3-13.
- KENNEDY, I. 2001. *Learning from Bristol - The Report of the Public Inquiry into children's heart surgery at the Bristol Royal Infirmary 1984-1995* [Online]. Available: http://webarchive.nationalarchives.gov.uk/20090811143745/http://www.bristol-inquiry.org.uk/final_report/the_report.pdf.
- KOLB, A. Y. & KOLB, D. A. 2005. Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of management learning & education*, 4, 193-212.
- KOLB, D. A. 2014. *Experiential learning: Experience as the source of learning and development*, FT press.
- LE FANU, J. 1999. The rise and fall of modern medicine. Nueva York: Carroll & Graf Publishers. Inc.
- LIEBERMAN, M. B. & MONTGOMERY, D. B. 1988. First-mover advantages. *Strategic management journal*, 9, 41-58.
- MAKARY, M. A. & DANIEL, M. 2016. Medical error-the third leading cause of death in the US. *BMJ: British Medical Journal (Online)*, 353.
- MAUDSLEY, G. & STRIVENS, J. 2000. Promoting professional knowledge, experiential learning and critical thinking for medical students. *Medical education*, 34, 535-544.
- MCGILLY, K. 1996. *Classroom lessons: Integrating cognitive theory and classroom practice*, MIT Press.
- MEDUCATION. 2017. *Cost of Training a Doctor* [Online]. Available: <https://meducation.net/resources/1760703-The-Medical-Education-Fraud> [Accessed 05 SEP 17].
- MITCH, D. 1999. The role of education and skill in the British industrial revolution. *The British Industrial Revolution: An Economic Perspective*, 2, 241-279.

- NEUFELD, V. R. & BARROWS, H. S. 1974. The "McMaster Philosophy": an approach to medical education. *Academic Medicine*, 49, 1040-50.
- NORMAN, G. & SCHMIDT, H. G. 1992. The psychological basis of problem-based learning: a review of the evidence. *Academic medicine*, 67, 557-565.
- PALIS, A. G. & QUIROS, P. A. 2014. Adult learning principles and presentation pearls. *Middle East African journal of ophthalmology*, 21, 114.
- PASHLER, H., MCDANIEL, M., ROHRER, D. & BJORK, R. 2008. Learning styles: Concepts and evidence. *Psychological science in the public interest*, 9, 105-119.
- PORTER, M. E., GOOLD, M. & LUCHS, K. 1996. From competitive advantage to corporate strategy. *Managing the multibusiness company: Strategic issues for diversified groups*, New York, 285-314.
- PRESSLEY, M., WOOD, E., WOLOSCHYN, V. E., MARTIN, V., KING, A. & MENKE, D. 1992. Encouraging mindful use of prior knowledge: Attempting to construct explanatory answers facilitates learning. *Educational psychologist*, 27, 91-109.
- PRINCE, K. J., BOSHUIZEN, H., VAN DER VLEUTEN, C. P. & SCHERPBIER, A. J. 2005. Students' opinions about their preparation for clinical practice. *Medical education*, 39, 704-712.
- PRINCE, K. J., VAN DE WIEL, M., SCHERPBIER, A. J., CESS, P. & BOSHUIZEN, H. P. 2000. A qualitative analysis of the transition from theory to practice in undergraduate training in a PBL-medical school. *Advances in Health Sciences Education*, 5, 105-116.
- ROBINSON, K. 2010. Changing education paradigms. *RSA Animate*, The Royal Society of Arts, London, <http://www.youtube.com/watch>.
- ROUSE, W. B. & SERBAN, N. 2014. *Understanding and managing the complexity of healthcare*, MIT Press.
- SCHMECK, R. R. 2013. *Learning strategies and learning styles*, Springer Science & Business Media.
- SCOTT, T., MANNION, R., MARSHALL, M. & DAVIES, H. 2003. Does organisational culture influence health care performance? A review of the evidence. *Journal of Health Services Research & Policy*, 8, 105-117.
- SOUSA, D. A. 2016. *How the brain learns*, Corwin Press.
- SPENCER, J. 2003. ABC of learning and teaching in medicine: Learning and teaching in the clinical environment. *BMJ: British Medical Journal*, 326, 591.
- SPENCER, J. A. & JORDAN, R. K. 1999. Learner centred approaches in medical education. *BMJ: British Medical Journal*, 318, 1280.
- STAHL, S. M. & DAVIS, R. L. 2011. *Best practices in medical teaching*, Cambridge University Press.

- TAYLOR, D. C. & HAMDY, H. 2013. Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. *Medical Teacher*, 35, e1561-e1572.
- TIDD, J. 1997. Complexity, networks & learning: Integrative themes for research on innovation management. *International Journal of Innovation Management*, 1, 1-21.
- TIDD, J., BESSANT, J. R. & PAVITT, K. 1997. *Managing innovation: integrating technological, market and organizational change*, Wiley Chichester.
- TOPOL, E. J. 2015. *The patient will see you now: the future of medicine is in your hands*, Tantor Media.
- TORJENSEN, I. 2018. Just 43% of FY2 doctors move straight into specialty training. British Medical Journal Publishing Group.
- VAN BERKEL, H. J. 2010. *Lessons from problem-based learning*, Oxford University Press, USA.
- WASS, V. 2005. Ensuring medical students are “fit for purpose”: It is time for the UK to consider a national licensing process. *BMJ: British Medical Journal*, 331, 791.
- WONG, B. M., LEVINSON, W. & SHOJANIA, K. G. 2012. Quality improvement in medical education: current state and future directions. *Medical education*, 46, 107-119.
- WOOD, T. 2009. Assessment not only drives learning, it may also help learning. *Medical Education*, 43, 5-6.

Appendix One - Additional Reading

1. <https://www.britannica.com/topic/medical-education> [Accessed on 08 JUNE 17]
2. <http://www.medicalarchives.jhmi.edu/osler/booksandmen.htm> [Accessed on 08 JUNE 17]
3. Tuteur, Amy (November 19, 2008). "[Listen to your patient](#)". The Skeptical OB. Retrieved April 9, 2012.
4. https://en.m.wikipedia.org/wiki/July_effect [Accessed on 08 JUNE 17]
5. http://www.gmc-uk.org/The_State_of_Basic_Medical_Education_0414.pdf_48903006.pdf
[Accessed on 08 JUNE 17]
6. <http://meded.ucsf.edu/sites/meded.ucsf.edu/files/documents/bridges-curriculum/luceymededprobsolutionjama-im2013.pdf> [Accessed on 08 JUNE 17]
7. <https://www.theguardian.com/higher-education-network/2015/apr/13/training-future-doctors-how-does-medical-education-need-to-adapt> [Accessed on 08 JUNE 17]
8. http://www.gmc-uk.org/The_State_of_Basic_Medical_Education_0414.pdf_48903006.pdf
[Accessed on 08 JUNE 17]
9. TEDx Maastricht - Lawrence Sherman "Turning Medical education inside out and upside down" https://youtu.be/YpSd5u_di9w [Accessed on 08 JUNE 17]
10. Why do top students do differently? Douglas Barton
TedXYouthTalinn <https://youtu.be/Na8m4GPqA30> [Accessed on 08 JUNE 17]
11. Clayton Christensen <http://www.ncmeresource.org/lcbp/pdf/webinar1/The%20Innovative%20University-Changing%20the%20DNA%20of%20Higher%20Education.pdf> [Accessed on 08 JUNE 17]
12. Disruptive Innovations In Higher Ed Emerging From Outside
Mainstream <https://www.google.co.uk/amp/s/www.forbes.com/sites/michaelhorn/2015/07/23/>

[disruptive-innovations-in-higher-ed-emerging-from-outside-mainstream/amp/](#) [Accessed on 08

JUNE 17]

13. Clayton Christensen disruption in HE <https://net.educause.edu/ir/library/pdf/ffp0201s.pdf>

[Accessed on 08 JUNE 17]

14. [https://www.google.co.uk/amp/www.govtech.com/education/3-Things-Higher-Education-](https://www.google.co.uk/amp/www.govtech.com/education/3-Things-Higher-Education-Should-Know-about-Disruptive-Innovation-.html%3FAMP)

[Should-Know-about-Disruptive-Innovation-.html%3FAMP](#) 3 Things Higher Education Should

Know about Disruptive Innovation Online learning presents both an opportunity and a challenge

as technology shakes up higher education. BY [TANYA ROSCORLA](#) | SEPTEMBER 30, 2014

[Accessed on 08 JUNE 17]

15. <http://www.ijiet.org/vol6/664-DL0013.pdf> Disruptive Innovation in Higher Education: The

Professional Doctorate G. Robinson, Member IACSIT, J. Morgan, and W. Reed, Member

IACSIT [Accessed on 08 JUNE 17]

16. <http://hbswk.hbs.edu/item/how-disruptive-innovation-is-remaking-the-university> [Accessed on

08 JUNE 17]

17. http://careers.bmj.com/careers/advice/Meeting_the_biggest_challenges_in_medical_education

Meeting the biggest challenges in medical education Authors: Helen Jaques [Accessed on 08

JUNE 17]

18. [http://www.kevinmd.com/blog/2010/01/acp-10-major-challenges-confront-medical-education-](http://www.kevinmd.com/blog/2010/01/acp-10-major-challenges-confront-medical-education-decade.html)

[decade.html](#) [Accessed on 08 JUNE 17]

19. <http://www.kevinmd.com/blog/2015/12/words-medical-educators-think.html> - basics becoming

too complicated in the first two years don't just teach but induce learning [Accessed on 08 JUNE

17]

20. http://www.gmc-uk.org/SOMEp_2013_web.pdf 53703867.pdf - the state of medical education

and practice in the UK [Accessed on 08 JUNE 17]

21. http://www.gmc-uk.org/static/documents/content/SOMEP_2016_Full_Report_Lo_Res.pdf 68139324.pdf - THE SOME 2013 [Accessed on 08 JUNE 17]
22. <https://www.wsj.com/articles/innovation-is-sweeping-through-u-s-medical-schools-1424145650> [Accessed on 08 JUNE 17]
23. <https://www.ncbi.nlm.nih.gov/pubmed/15008299> [Accessed on 08 JUNE 17]
24. <http://www.gmc-uk.org/publications/31197.asp> changes to revalidation [Accessed on 08 JUNE 17]
25. Cost of medical education <https://meducation.net/resources/1760703-The-Medical-Education-Fraud> [Accessed on 08 JUNE 17]